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CASTING THE CONCRETE LIONS FOR CONNECTICUT AVE. BRIDGE, WASHINGTON, D. C.

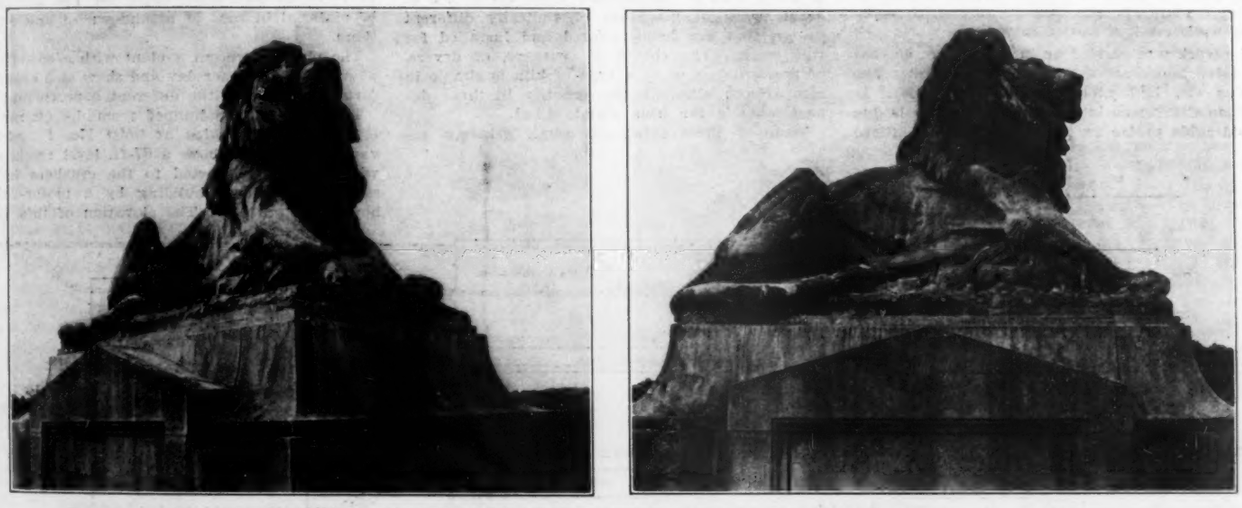
In our previous descriptions of the large concrete bridge which carries Connecticut Ave. across Rock Creek gorge at Washington, D. C., we have mentioned the large concrete lions which are placed on each of the four end newels of the bridge railing. These figures have recently been successfully cast and we are able to present here a view of one of the finished lions and also a description of the methods used in the casting. The molding of large and intricate figures in concrete is a comparatively recent process, and even now is in the hands of a few specialists, but the highly artistic effects that some of these gentlemen have been able to procure makes it apparent that there is a wide field for this work.

The Connecticut Ave. Bridge lions are in two models—for the opposite sides of each end—after the designs of Mr. R. Hinton Perry, the New York sculptor, whose Neptune fountain in front of the Library of Congress is well known to all who have been in Washington. Mr. Perry furnished quarter-size models, for the approval of the Engineer Commissioner, Maj. J. J. Morrow, and the Consulting Architect, Mr. E. P. Casey, and two full-size models for the use of the casting contractor, the Erkins Co. of New York City. The full-size lion rests on a pedestal (shown in the half-tone), is about 9 ft. high, and is of solid concrete. In each lion there is the following reinforcement: one ¾-in. pipe in each fore leg, one 1½ round rod in the curled-up tail and one ½-in. round rod placed in a horizontal plane about the level of the mouth so as to reinforce the head. Each of the figures was cast in place on its pedestal, two plaster molds being used for the four figures. The method of preparing these molds and of laying the concrete are the features of the work that merit description, although mention should be made of the care taken by Mr. Perry in modeling the figures so that the concrete casting could be accomplished, at the same time obtaining fine detail and bold relief.

The models were shipped from Mr. Perry's studio in Hoboken to the plant of the Erkins Co. in New York, and there the plaster molds were made. These molds consisted of about 150 pieces, varying from 9 to 24 ins. in thickness, interlocking so as to form strong backing when set up and, in the longer pieces, reinforced with 1-in. iron pipe and wooden strips. These pieces were so designed that the last piece placed was a key which had to be removed first in the dismantling process. Where undercuts necessitated a separate small mold, for ease in removal, these smaller pieces were tied to the back mold with rope running through holes in both pieces and tightened on the outside by wedged-up toggle-sticks. When the molds were removed the rope was cut, allowing the removal of the outer form first, and then the undercut block was taken out without damaging the overhanging piece of concrete.

In the casting the mold was first set up entirely around the figure for a height of 2 ft. 6 ins., then the inside of the joints carefully pointed up with plaster of Paris and finally the molding surface was covered with two coats of shellac to prevent adhesion of the cement to the mold. Inside of the figures a rough form was placed about 5 ins. from the face forms so that a surface coating could first be cast, afterward to be backed up by a central filling. Accordingly this surface layer was placed in 8-in. thicknesses, worked well in by the hands and then successively rammed; first, with small iron rammers about 2 ins. in diameter, so as to occupy about two-thirds of the original space; second, with wooden mallets, and third, with sand bag rammers (about a quart of sand to a bag) until an impression could no longer be made with the hand. The surface was then scratched with a nail or trowel for bonding and the interior space filled in with a wet 1:2:4 concrete. The mixture used in the facing was dry and is described below. The work proceeded thus in 2 ft. 3 in. layers up to the top and the keying was made in the head of the lion.

In regard to the mixture used in the facing, we would quote Mr. W. J. Douglas, M. Am. Soc. C. E., Engineer of Bridges of the District of Columbia, who had charge of the construction, and who kindly furnished us with the accompanying information. Mr. Douglas says:



ONE OF THE FOUR CONCRETE LIONS AT THE APPROACHES OF THE CONNECTICUT AVE. BRIDGE.

The mortar facing was placed so dry that no amount of hammering or ramming resulted in flushing of water to the surface. The following formula was used for the facing mortar. It was the intention to get a limestone effect, which was attained.

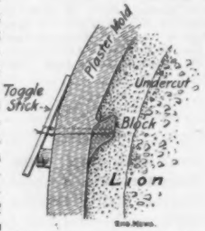
AMOUNT OF MATERIAL USED IN ONE BATCH.

2 cu. ft. Dexter Portland Cement.
1 cu. ft. Blanc Stainless Cement.
6 cu. ft. Indiana limestone sand (⅛ in. down).
5 qts. refined yellow ochre.
1 qt. waterproofing.
7½ gals. water.

This material was carefully mixed. The cements were first carefully mixed together to a uniform color and the ochre and waterproofing were then added and the material was again mixed to an even color. It was then spread out and the limestone sand was added and the materials were again mixed to a uniform color. The whole mass was then turned over four times (raking at the same time) the water being added by sprinkling from a watering-can during this last mixing.

The mold was kept in place two days. After the removal the concrete lions were kept wet for three weeks and on the warmer days they were covered with wet bags. Upon the removal of the mold the work was found to be excellent. After three weeks the carving or tooling of the lions was begun. This carving or tooling consisted largely of tooth chiseling the surface so as to remove the plaster of paris which appeared as flour over a small portion of the two lions, to produce a uniform appearance, to obliterate the few marks, to accentuate to a slight extent the detail and to bring out a small amount of undercut work which could better be brought out this way than by molding.

The method employed of using dry facing concrete, while hardly novel, is, I believe, new to many engineers, so it may be worth while to give the theory on which it is based. In nearly all engineering work today, even for ornamental work, concrete and mortar is cast very wet. Economy as a rule governs the use of this wet mixture for ornamental work and other practical reasons demand it for mass and reinforced-concrete work. However, in ornamental work which cannot be cast upside down and afterwards set in place, we have much trouble with laitance efflorescence and hair cracks resulting from the floating of the finer material to the top. In addition to this we find a weaker mixture in the top surface and air holes in the other surfaces. The most serious trouble resulting from the use of a wet mixture is shrinkage and where the design is such that the concrete passes from large to small sections very rapidly, the resulting shrinkage cracks cannot be prevented, even with a liberal use of steel; further, this shrinkage causes a less decided cast, causes greater adhesion to the mold and makes it almost impracticable to get the heavy undercut blocks out without injury to the cast. In order to have the mortar facing set up evenly from the inside as well as from the outside, the backing concrete was made very wet so that the mortar facing would rob it of part of its water.



Method of Holding Undercut Blocks to the Main Mold.

The work was carried on in September, so that excessive temperatures were not met with. The Erkins Co. had nine men engaged. Mr. E. Weedon Clark was in charge, and to him is due considerable praise for the successful execution; under him there were two skilled mechanics who could work inside the lions and six laborers. With this force it took about one week to complete each lion, from the assembling of the molds to the finishing tooling. The completed figures are remarkably good, only a few defects being found on the work. There are a few spots on each lion about the size of a walnut, where the cement set up without sufficient ramming, and one small piece of undercut work had to be cut out and replaced.

Although costs in this detailed casting are not of much value in estimating other work, because the various factors which enter into the construction are so variable, it may be of some value to state that the contract was let at about $150 per cubic yard of concrete laid, this price covering the entire construction, but not the fee paid to the sculptor, whose work was under separate contract.

The accompanying half-tones show the admirable modeling achieved by Mr. Perry and the excellent quality of the execution. Unfortunately there is no accompanying scale by which the size may be judged, but it may be remembered that the pedestal base in line with the lion is somewhat over 12 ft. in length and that the top of the head is 9 ft. from that same base and about 14 ft. from the roadway of the bridge.

A DESIGN FOR A PORTLAND CEMENT PLANT WITH A CAR SYSTEM FOR TRANSPORTING MATERIALS.*

By C. J. TOMLINSON.†

A method of manufacture of Portland cement calculated to develop a logical evolution of economies in the work should be the object of every progressive plant manager. The extent and rapid growth of the industry has made it possible to expend considerable sums in the effort to accomplish economies; an economy of 1 ct. per barrel or less than 2% of the mill cost of manufacture, will pay 10% on an investment of $182,000, in a 5,000-bbl. plant. But if this work is not followed up in a logical manner the results fall far short of the possible economies that could otherwise be effected. The best interests of the industry are centered in this problem of cost reduction, and its solution.

A cement plant manager contemplating the purchase of grinding machinery for rough grinding has, at the present time, the choice of eight types of machines of radically different design that are being offered and installed for this work. The choice of crushers, of dryers, of fine grinders or of a type of kiln is simple in comparison; although the practice in these departments is far from standardized.

Each of these types of rough grinders referred to has a certain economic adjustment, speed of driving, rate of feed, degree of fineness of the material being fed and fineness of production. Then, too, the nature of the materials being treated varies in the different localities.

These machines are designed under the most empirical rules as to proportions and economic size, and are usually installed over a mill conveyor alongside a number of other grinders, given a short test as to rate and fineness of production and then thrown out or enthusiastically adopted. In the latter event the continuous duty required of them develops a thorough understanding of their peculiar defections—the store room repair charges for some part are considered excessive—and the search is resumed.

In order to successfully evolve an ideal design or type of machine for this work it is necessary to secure complete data of the performances of the various modifications leading up to this result. It is not enough to know that a machine will do the work; it is of the highest importance to know by cost what amount a change in design or operation affects the economic result.

The obvious method to accomplish this is to weigh all of the production of the different machines and to test it periodically as to fineness; in fact, create an immense testing department of the grinding departments in which the different modifications are tested to destruction under the most searching and equal competition.

In order to do this, it is necessary to install a conveying equipment that will make it possible to give the different machines individual attention. In an effort to solve some of these requirements, I have prepared the accompanying tentative plans of such a plant. The various types of continuous conveyors and elevators are not readily adaptable to these requirements and are also a source of considerable annoyance in the operation of a large plant, and in these plans have been replaced with an arrangement of electrically-operated scale and larry cars and skip hoists. The elevating is concentrated in four double-track skip hoists with skips of 12 tons capacity each. These hoists are so situated as to form an alternative path for the movement of material in case of breakdown of any one of them.

The plans represent a plant with a capacity of about 5,000 bbls. per day and show also space for future increase in the different departments.

The rock is first dumped from the quarry car into one of the skips at hoist No. 1 and elevated to the bin above a 67-ft. level track, over which it is transported to the crushers in the crusher and dryer building by a motor-driven hopper-bottom car. The elevation of this track is enough to provide a gravity path for the material through screens, crushers, dryers and rolls, from which it falls into bins over the regular narrow gage yard tracks. The cars operating on these yard tracks are similar to those in use in the storage yards of blast furnace plants and consist of two short bogies with railway type motor and having a heavy hopper-bottom car body hung on suitable scales.

The material is taken from the dryer house back to hoist No. 1, elevated and transferred to

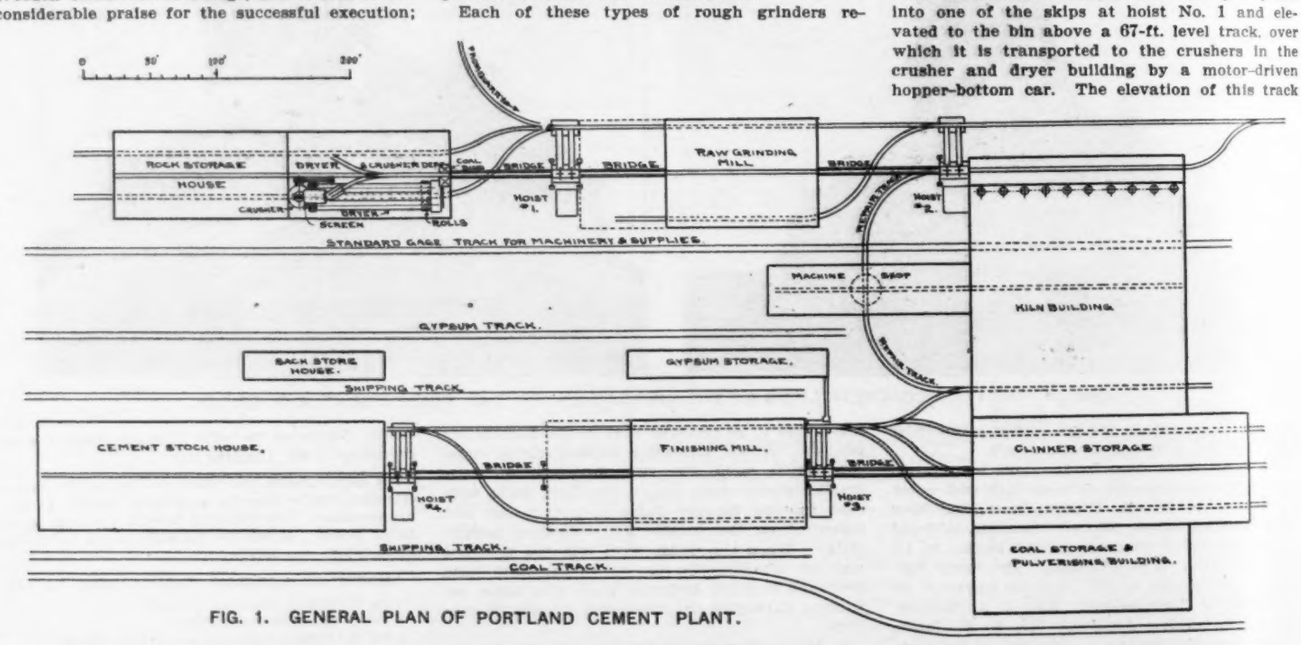


FIG. 1. GENERAL PLAN OF PORTLAND CEMENT PLANT.

*See also paper by the same author in Engineering News, Feb. 13, 1908, p. 171.
†Bath, Pa.

the raw mill directly, or to the rock-storage bins beyond the dryer and crusher building. In case the material is taken to storage-bins, it is subsequently transferred by the scale car to hoist No. 1 and thence to the raw mill. The scale car then moves on beneath the raw mill to receive the ground material, which it transfers to hoist No. 2. This hoist is similar to No. 1, with the addition of suitable dampers or doors to confine the dust, and delivers the powdered material to the car operating over the kiln room bins and raw grinding department.

The plan of the yards and the elevations shown should make this readily understood, and as the system of handling the clinker and cement is very similar to that for the raw material, it will not need further explanation. The clinker may be taken from the kiln bins and readily handled at a much higher temperature than is practical with continuous conveying machinery. The clinker storage yard for aging the clinker will require the services of a special machine, a pair of heavy motor-driven rolls mounted complete with two swinging booms carrying short belt conveyors. This outfit should be mounted on two narrow-gage bogies so that it may be readily moved from place to place under the yard or the machine shop. The wear on these roll shells is very rapid and the shop crane will expedite the repairing required. A spare outfit of this sort would be found useful in replacing the services of a pair of rolls, undergoing repairs, in the rock-dryer department.

The plans show no dryer department for drying the clinker taken from the storage yard. If there are good and sufficient reasons for saturating this clinker, as is done in some plants, a dryer department should be introduced between hoist No. 3 and the finishing mill.

It should be practicable to serve the entire plant, on occasion, with four motormen, one operating a car on each of the elevated tracks and one on each of two cars in the yard systems. The hoists may be started from the scale car platforms and will automatically stop themselves, as is the practice at a number of blast furnace plants.

In these plans no concessions have been made in an effort to economize in first cost of erection, nor are they intended to do more than clearly show the application of the conveying equipment. In regard to the question as to whether departments of this arrangement will give as good results in maintaining or perfecting the proper mix on the raw side, it should be noted that the storage department here shown, in connection with the scale cars, offers a system that should be of considerable value in producing the required mixture; and the operation of dumping into hoists, then to bins, then to cars again, then to bins over machines, should mix the charge as completely as is ever accomplished by the use of a common conveyor in a commercial plant. And then the powdered material is given this working again in the process of delivering it to the kilns.

The intimate admixture of the materials accomplished by the average conveyor system is of meager value in comparison to that produced in the average fine grinder.

In conclusion, these plans show a radical departure from accepted designs for this work, but as the plants have increased in size, it has become more and more evident that the problem of efficiently serving the machines could only be met by a most radical solution. The serving machinery should combine efficiency and flexibility, be a ready means of information regarding the machines it serves and, finally, be of the greatest aid and least interference in the difficult tasks of repairing these machines.

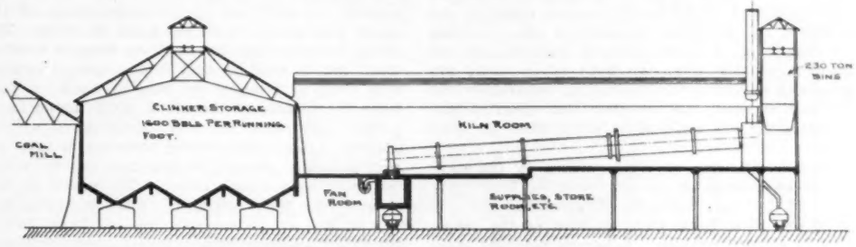


FIG. 2. LONGITUDINAL SECTION THROUGH KILN ROOM AND CLINKER STORAGE.

THE OXY-ACETYLENE PROCESS OF CUTTING AND WELDING.*

The oxy-acetylene process for autogenous welding and emergency cutting of metals was first introduced into this country from France about seven years ago. At present there are three or four companies in the United States manufacturing the oxy-acetylene apparatus under the French patents but with various individual modifications in details of construction.

The acetylene is generated from calcium carbide in the same general way as for illuminating purposes. It is desirable, however, to have a slightly higher pressure in the acetylene line in the case of the blowpipe, and generators have been devised which produce the gas under pressures as high as 15 lbs. per sq. in. The pressure is regulated in the Goodyear generator by floats which move with the level of a water surface controlled by the pressure in the generating chamber. The movement of these floats controls the supply of carbide falling from the hopper into the water in the generating chamber. In the Davis pressure generator the amount of carbide admitted to the generating chamber depends upon the rotation of a ring equipped with vanes which "plow" the carbide from the edge of a circular plate upon which it flows from the hopper. This ring, or plow, is driven, through a train of gears resembling clockwork, by the action of a descending weight. The clockwork is stopped or released by a lever actuated by a rawhide diaphragm upon one face of which acts the acetylene pressure. In both these types the pressure may be set at any point within their respective ranges by simple adjustments of the regulating devices. In ordinary work the acetylene is piped direct through a reducing pressure valve from the generator to the torch, or blowpipe. When a portable outfit is needed, the acetylene is dissolved under pressure in acetone and stored in cylindrical steel tanks.

The apparatus for generating oxygen has not yet reached as high a degree of standardization. It is desirable, especially in welding, that the oxygen supply be pure and of constant quality in order that the flame may be definitely regulated so as not to oxidize the metal. For small installations, the oxygen is supplied stored in cylindrical tanks at a pressure of from 125 to 200 lbs. per sq. in., but, in cases where this would be inconvenient, it can be generated at a reasonable cost by the well-known chlorate of potash process and compressed into tanks at the place where it is to be used. The compressor for this purpose must be of special construction, taking into account the nature of the gas upon which it works. Cylinders, pistons and all parts with which the oxygen comes in contact are faced with copper, and ordinary lubricating oil cannot be used, as it is liable to be vaporized forming with the oxygen an explosive mixture. From the tanks the oxygen is led through tubes to the blowpipe, and a pressure regulating valve is used, as in the case of the acetylene.

The blowpipe, or torch, is the main feature of the oxy-acetylene apparatus and it is mainly in the details of its construction that the outfits of the different manufacturers differ. There are two general types, one of which operates on the injector principle. The oxygen at relatively high pressure (15 to 20 lbs.) passes with con-

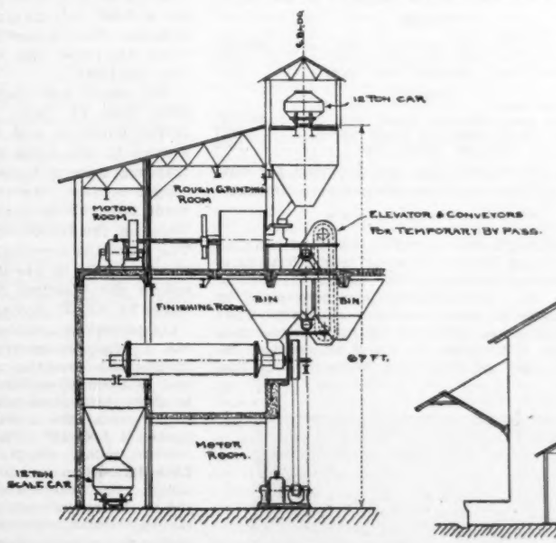


Fig. 3. Half Cross-Section of a Grinding Department.

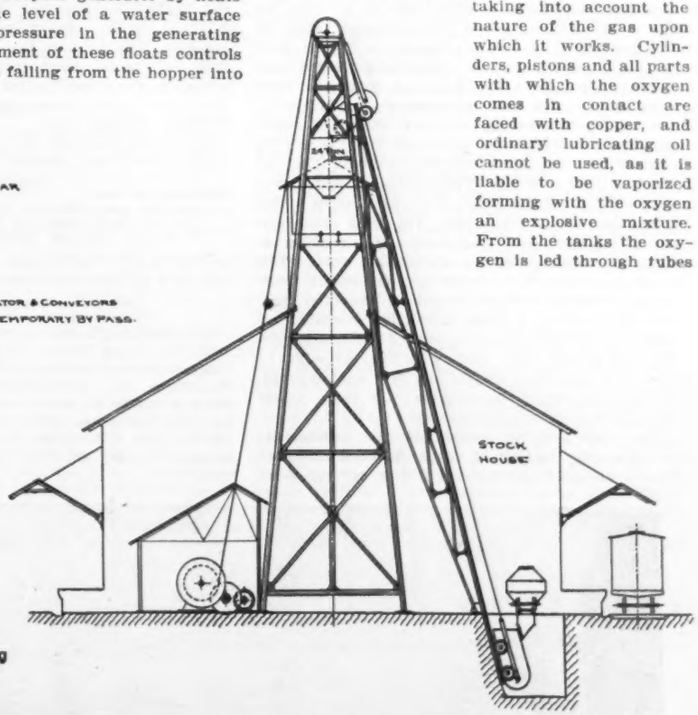


FIG. 4. ELEVATION OF 12-TON HOIST BETWEEN FINISHING MILL AND STOCK HOUSE.

*A previous article on this process was published in Eng. News, June 27, 1907, p. 706.—Ed.

siderable velocity past the openings through which acetylene is admitted at a pressure generally less than 1 lb. per sq. in. and draws the acetylene with it to the flame end of the nozzle. In the second, or pressure, type of torch, the acetylene is brought to the mixing space in the nozzle at a pressure of about 5 lbs., it being claimed that a more definite mixture can be secured in this way. In both types cocks are provided at the torch controlling separately the amount of each gas so that the operator can regulate at will the size of flame and the mixture.

A demonstration of steel cutting by the oxy-acetylene process given at Columbia University Oct. 23 by the Equitable Engineering Co., 60 Wall St., New York, gave an idea of the possibilities of this method. A bar of machine steel of rectangular section, 2 ins. × 3½ ins., was cut through in about one minute, a 9-in. I-beam in less than two minutes, and a 4-in. × 6-in. beam built up of four 1-in. steel plates riveted together was cut through in slightly less than six minutes, after a brief preheating with the same torch. The torch used at this demonstration was the "Pyrokopt" torch made by the Linde Air Products Co., of Buffalo, N. Y. Acetylene was supplied by a Goodyear generator and was brought to the torch at a pressure of about 10 ins. of water. The cutting torch differed from the welding torch of the same make in having a third tube for high-pressure oxygen. This tube ends in a conical nozzle within the nozzle carrying the oxy-acetylene mixture and delivers a strong jet of oxygen in the center of the flame of the torch. It is this oxygen jet that does the cutting. The surrounding flame brings the steel to a temperature so high that it is burned through upon the application of the jet of oxygen. The cutting jet was supplied with oxygen at a pressure of 190 lbs. per sq. in. Welds were made at this demonstration in steel, cast iron and aluminum. In welding cast iron, a rod of a special composition was used to provide an excess of metal to allow for machining, etc. In the case of steel and aluminum, a rod or wire of the same material as that being welded was employed in the same way. A flux was used with the steel to prevent excessive oxidation.

A most interesting demonstration of oxy-acetylene welding was given at the factory in Jersey City of the Davis-Bournonville Co., 90 West St., New York. Two plates of ⅝-in. cast iron were welded together forming a strip about 8 ins. long and 2 ins. wide. This was then supported at each end and broken by striking it with a hammer directly above the weld. The break was irregular, three or four small fragments breaking out, as would be expected in a solid plate, and a close inspection revealed no indication of the joining in any of the fragments. Two pieces of strap iron were welded edge to edge and then bent over along the weld through an angle of 90° by hammering in a vise. There was no sign of any separation.

The most striking feature of this demonstration was the welding of copper to steel and cast iron to steel. In both cases a thorough mingling and perfect union of the two metals seemed to be effected. The weld of steel and cast iron was tried on an emery wheel and it was found that there was a continuous gradual variation from steel to cast iron, or vice versa, it being impossible to pick out by the appearance of the spark any one point as the point of union. The Davis-Bournonville Co. used no flux in welding steel, but in welding cast iron a special powder was used to remove the film of scale or rust from the surface of the metal after fusing it.

The torch used by this company is of the pressure type. For cutting purposes, a tube for high-pressure oxygen is attached to the welding torch by a simple clamp. The nozzle of this tube is then close beside the heating nozzle and projects about ⅛-in. beyond it so that in use it may be brought closer to the metal being cut. In making a cut, the torch was moved so that the oxygen jet followed the flame. The web of a 15-in., 60-lb. I-beam was cut through in one minute. The kerf in this case was about ⅛-in. wide. Costs per hour, including labor at 30 cts. per hour, are given by this company as follows:

Welding.

Thickness of metal:	
1/32-in. to 1/16-in.; cost per lineal foot	$0.0087
⅛-in. to ¼-in.; cost per lineal foot	.054
7/16-in. to ½-in.; cost per lineal foot	.374

Cutting.

Thickness of steel:	
⅛-in. or less; cost per lineal foot	$0.0447
¼-in. to 1½-in.; cost per lineal foot	.0627
1½-in. up; cost per lineal foot	.1005

Nozzles of several sizes are provided for cutting and welding different thicknesses of metal.

INFRINGEMENT OF PATENTS ON MECHANICAL filters is charged in a suit brought by the New York-Continental-Jewell Filtration Co. against the city of Harrisburg, Pa. Arrangements have been made by which a number of other cities using mechanical filters will cooperate in the defense of the suit. Among them are the cities of Louisville, Ky., New Orleans, La., Columbus, O., and the Hackensack Water Co., of New Jersey.

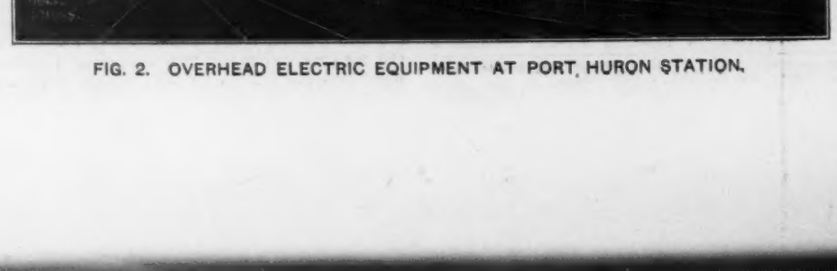


FIG. 2. OVERHEAD ELECTRIC EQUIPMENT AT PORT HURON STATION.

THE ELECTRICAL EQUIPMENT OF THE ST. CLAIR TUNNEL, GRAND TRUNK RY.

The submarine tunnel under the St. Clair River, between Port Huron, Mich., and Sarnia, Canada, was completed in 1900. It is a single-track, iron lined tube tunnel, 19 ft. diameter, 6,032 ft. long, with approach grades of 2%. The total distance between the ends of these approach grades is about 2¼ miles.

Four tank locomotives of special design were built to handle the trains on this tunnel line, which is operated as a separate division. These locomotives were arranged to burn anthracite coal in order to avoid the inconvenience due to heavy smoke in the tunnel. Their maximum tractive effort limited the train loads to about 760 tons, and even with this load the speed was often very low on the approaches. With the growth of traffic, the capacity of the line was overtaxed, and the number of trains became so great that the ventilating equipment was overtaxed. Several accidents occurred, and trains were stalled owing to the crews becoming overcome by the gas-laden atmosphere of the tunnel.

FIG. 1. ELECTRIC LOCOMOTIVE FOR THE ST. CLAIR TUNNEL, GRAND TRUNK RY.

In order to increase the traffic capacity, and to eliminate the dangers incident to steam locomotives in the tunnel, it was decided to adopt electric traction, and Mr. Bion J. Arnold, M. Am. Inst. E. E., was engaged to investigate and report upon the matter. After consideration of his report, Mr. Arnold was commissioned to prepare the necessary plans and specifications, and in 1905 a contract for the necessary plant and equipment was awarded to the Westinghouse Electric & Mfg. Co., which had submitted a bid for a 3,000-volt alternating-current single-phase system. The general features of this system were described and illustrated in our issue of Jan. 18, 1906.

The plant has been in continuous operation since May 17, 1908. It has handled the entire traffic, which is said to be the heaviest railway service in the world that is operated by electric traction, since it includes freight as well as passenger service. An inspection of the work was made Nov. 12 by a party of engineers and officials, on the invitation of the Grand Trunk Ry. The following description of the plant and equipment as now in use is taken from a paper read before the Western Society of Engineers (Chicago) by Mr. F. A. Sager, of the Arnold Co.:

LOCOMOTIVES.—One of the locomotives is shown in Fig. 1. Three locomotives have been provided for this service, each consisting of two half-units. Each half-unit is mounted on three axles driven through gears by three single-phase motors with a nominal rating of 250-HP. each. The nominal power of the complete locomotive is 1,500-HP. The motors have a very liberal overload rating, and it is easily possible to develop 2,000-HP., and on occasion in excess of this, in one locomotive. The half-units are duplicates in every respect, and as the multiple-unit system of control is used, they can be operated when coupled together with the same facility that a single-phase half-unit can be operated.

The locomotives are designed to develop a drawbar pull of 50,000 lbs. at the comparatively low speed of 10 miles per hour. They are powerful enough to start a 1,000-ton train on a 2% grade in case this should be necessary, and can haul this train at 11 to 12 m. p. h. on the grade. At a test (using a dynamometer car), it was found that a single half-unit developed 43,000 lbs. drawbar pull before slipping the wheels. This was done on a comparatively dry rail, with a liberal use of sand. On this basis it would be possible to develop about 86,000 lbs. drawbar pull with a complete locomotive.

The maximum speed of the locomotives is 35 m. p. h. It is not the intention to operate them at a speed in excess of 30 m. p. h. Speed indicators are provided, with a large dial in the cab. These indicate the speed at which the locomotive is running, and record the speed throughout the run. It is estimated that an engine can

make the trip between terminals with a 1,000-ton train in 15 min. This would provide for four 1,000-ton trains per hour.

Inside the cab is located practically all of the apparatus, with the exception of the motors and the brake rigging. Included in this apparatus is a single-phase transformer used for reducing the current from 3,300 volts to a voltage suitable for application to the motor. The transformer, as well as the motors, are air-cooled, the supply of air being furnished by an electrically driven blower in the cab. The blower is driven by a single-phase motor, the current being supplied at 100 volts by a tap from the main transformer. With the moderate supply of cooling air furnished by the blower fan, both transformers and motors are able to operate at full capacity with comparatively little increase in temperature above that of the surrounding air. The air for the cooling is taken through a shutter in the side of the locomotive cab, and is distributed through sheet metal ducts installed under the floor to the three motors and to the transformer. From the latter, the air passes either through an opening in the floor of the cab into the open air, or, if desired, into the interior of the cab. In the latter case an appreciable amount of heat can be secured from the main transformer for heating the cab.

Motor-driven air compressors are also located in the cab. The air brake equipment is of the standard type used for electric cars and locomotives, with the exception of the motors, which are single-phase. They are operated by means of an electric controller, which serves to keep the normal air pressure at about 100 lbs. The compressed air operates both the automatic and straight air equipment on locomotive and train, and is used for a variety of minor purposes in and about the locomotive. All of the contactor switches used in controlling the operation of the locomotives are air operated, the air valves being operated by direct-current electrical control. This is also true of ringing the bell, blowing the whistle, raising and lowering the trolley, and applying sand to the tracks.

Speed control of the locomotive is effected by varying the voltage at the terminals of the motors. This is effected by making connection with various transformer taps by means of the air operated, electrically controlled contactor switches. Electric control of the contactors is effected through the master controller, which in the electric locomotive replaces the throttle valve in the steam locomotive. The current for the master controller is furnished by a small storage battery operating at about 20 volts, the battery in turn being charged by means of a small motor-generator set.

The electric controller has 21 points in all, 17 of which are running points. This provides for an increase in the speed of the locomotive from the lowest running speed to the maximum speed by very slight gradations, thus making it possible to maintain practically constant drawbar pull, while the locomotive is accelerating the train. This is very desirable, as the minimum variation in the drawbar pull while handling the train through the tunnel decreases the liability of breaking the train in two. Particular attention was given this phase of the train operation in designing the locomotive, and the resulting remarkable decrease in the number of breaks-in-two since the operation with electric locomotives is a source of great satisfaction.

On the master controller is also located the reverse lever, which controls through the electrically operated solenoids the air operated contactors used in reversing the motor connections. Here also are located the push buttons, which serve to raise and lower the trolley, operate the front and rear sanders, reset the circuit breaker, and ring the bell. The ringing of the bell and the application of sand by means of the front and rear sanders are also controlled by foot pedals.

Each half-unit is arranged for operation in either direction; air valves, a master controller and ammeter being located at each end of the cab. By means of cable couplings, the control system of two or more half-units can be thrown in parallel, thus providing for the operation of any number of half-units from any master controller. In this way the two half-units are generally operated in the handling of freight trains through the tunnel. The passenger traffic can ordinarily be taken care of by a single half-unit.

The current is collected from the trolley wires (22 ft. above the track) by means of a sliding bow pantagraph trolley. Electric headlights are provided, as well as lights for the illumination of the interior of the cab and the dials of the indicating instruments. The heating of the cabs is provided for by means of standard electric heaters. Heat is also available for drying the sand stored in the sand boxes. In general, the M. C. B. standards have been conformed with. The general dimensions of each half-unit are as follows:

Length over all	23 ft. 6 ins.
Height, top of rail to top of roof	13 " 0 "
Height, top of rail to top of pantagraph bow when lowered	14 " 11 "
Width over all	9 " 8 "
Total weight (evenly divided over three drivers)	67½ tons
Weight of complete locomotive unit	135 tons
Length of rigid wheel base	16 ft.
Diameter of driving wheels	62 ins.
Normal speed of train ascending 2% grade	10 m. p. h.
Normal speed on level tracks	25 to 30 m. p. h.

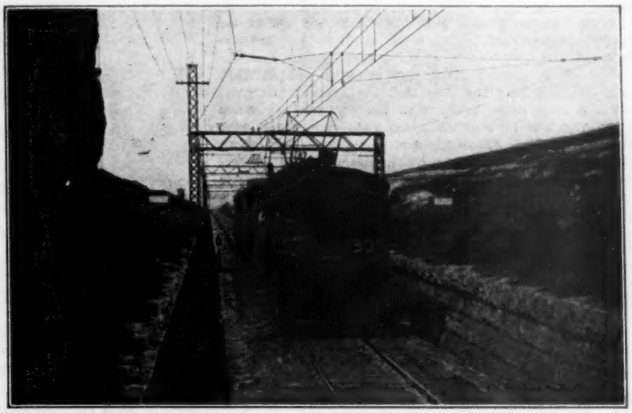


FIG. 3. OVERHEAD EQUIPMENT ON TUNNEL APPROACH.
(Tall steel columns supporting the high tension transmission lines are seen at the left.)

PUMPING.—This is necessary to free the tunnel approaches from water due to rain storms or melting snow, and the small amount of condensation and seepage water collecting in the tunnel. For this purpose pumping plants have been installed at both tunnel portals. That at the Port Huron entrance consisting of two centrifugal pumps, each capable of delivering 4,000 gals. per min., driven by direct-connected, 100-HP., three-phase, 25-cycle, 3,300-volt, induction motors. That at the Sarnia entrance consists of two 5,500-gal. pumps driven by two 200-HP. motors of the same type. In addition a 150-gal. pump driven by a small induction motor is located in each pump house, these pumps serving to take care of the small amount of water that is constantly finding its way into the drainage wells.

The centrifugal pumps used in this service can be primed by means of the water stored in the large discharge pipes. Valves controlling the flow of water are all located so as to be conveniently accessible for the pump-house operator. The equipment has been found to operate in an entirely satisfactory manner, and provides for the handling of water with a minimum amount of attendance and expense.

Two 150-gal., motor-operated, centrifugal pumps are located at the foot of the Sarnia grade, and serve to remove from the tunnel the condensation and seepage water, delivering it to the well at the portal. The seepage pumps are similar to the small pumps installed at the portal pump houses, with the exception of motors, which for this service are entirely enclosed, suitable for continuous operation in the tunnel, where they are liable to be subjected to more moisture than are the motors located in the pump houses.

LIGHTING AND POWER.—Incandescent lamps in the roundhouses, the passenger stations and the Y. M. C. A. buildings in both Port Huron and Sarnia are furnished with current from the electric power plant by means of step-down transformers, reducing the voltage from 3,300 to 110 volts. Motors operating at 3,300 volts have been installed in the roundhouses at Sarnia and Port Huron, the current supply being taken from the power plant.

In all, 480 lights have been installed throughout the tunnel on either side at a height of 10 ft. above the rail. The tunnel lamps are operated four in series from the 440-volt secondaries of the lighting transformers installed in the tunnel. Similar transformers furnish the current supply for the tunnel drainage pump motors.

In addition about 30 arc lights have been provided and installed in the yards at either terminal. These are for general illumination around passenger stations, roundhouses, and coal chutes. The current for the arc lights is furnished at the power plant by means of a mercury arc rectifier. The total amount of lighting is somewhat under 100 KW., which, together with the motor requirements of 100 KW., makes a total of slightly over 200 KW. for small power and lighting outside of the plant.

ELECTRICAL DISTRIBUTION SYSTEM.—For the distribution of the single-phase current to the locomotives, substantial steel towers have been erected throughout the tunnel yards. The steel work used for supporting the working conductor consists of strong lattice columns supporting bridges of trussed construction. The average spacing of the overhead bridges is 250 ft. They are designed to extend over all tracks that are to be electrified. Those located at passenger station extend also over the platforms, thus in no way interfering with the access of passengers to and from the trains. This necessitates a length of about 141 ft. in case of some of the bridges located on the Port Huron side, the bridge spanning seven electrified tracks, in addition to the station platform. This is shown in Fig. 2.

Single catenary construction is used throughout, a messenger cable of ⅝-in. extra heavy galvanized steel being suspended immediately over the center lines of the tracks. The working conductor is attached to the messenger cable by means of fittings of varying lengths, so arranged as to support it at a uniform height of 22 ft. above the top of the rail. No. 0000 hard-drawn grooved copper is used througtout the yards. On the approaches and through the tunnel two 300,000-cm. conductors have been installed. The messenger cables forming the catenary construction terminate at the tunnel portals, where they are securely anchored to eye bolts imbedded in the heavy masonry portal. At this point the messenger wires supporting the working conductor in the tunnel are anchored to special brackets located on the tunnel face. The conductors in the tunnel are continuous with those on the tunnel approaches.

The method of supporting the trolley inside of the tunnel shell was conditioned by the requirement that complete overhead equipment should not encroach on the tunnel opening more than 9 ins. This has been accomplished by bolting to the tunnel shell special iron brackets, each of which supports two spool-shaped insulators. These insulators in turn support steel messenger cables, which are drawn taut throughout the length of the tunnel, and attached to brackets at the tunnel portal. Special clamps are attached to these messenger cables at points between the insulator supports, and these in turn serve to support the two trolley wires. The insulating supports are attached to the tunnel shell at intervals of 12 ft., as also are the clamps connecting the messenger cable with the trolley. This method provides an attachment at once sufficiently rigid to maintain the proper clearance between the trolley and the tunnel shell, and at the same time sufficiently flexible to provide for the proper operation of the trolley bow on the overhead conductor. Section switches have been provided where necessary to permit of disconnecting the working conductor over any switch track from the main line extending throughout the tunnel.

The columns at one end of the bridges have been extended above the bridge to support the transmission wires which supply current for the power and lighting service at the roundhouses and stations, as well as for the arc light circuits. (Fig. 3). Overhead lines terminate in the pump houses, at either tunnel portal, where they are connected with the underground feeder system at the panel boards.

All feeder lines connecting the various parts of the

FIG. 4. VIEW OF TUNNEL PORTAL.

equipment to be supplied from the power plant are carried in the tunnel conduits. For this purpose four conduit lines have been laid on either side of the tunnel. Connection has been made with these conduit lines at a point about 1,700 ft. from the Port Huron portal by a vertical shaft extending from the top of the tunnel to the surface of the ground, terminating at about 75 ft. from the power plant. The overhead feeders (terminating as above noted in the portal pump houses) are continued as underground feeders down through the tunnel and up the shaft, finally terminating in the switchboard at the power plant.

For the pumping service, two independent feeders are laid from each portal pump house, one being installed on either side of the tunnel and both terminating at the power plant switchboard. The heavy feeders for supplying the locomotive current to the trolley extend from the tunnel through the vertical shaft to the powerhouse. This arrangement provides for all feeders leaving the power plant underground. The cables are paper insulated, lead encased and are installed in tile ducts.

POWER PLANT.—This is located on the Port Huron bank of the St. Clair River, about 100 ft. from the center line of the tunnel. The foundation footings were carried down to the clay, and were designed for a bearing pressure of 2 tons per sq. ft. All of the column footings supporting the coal bunkers, as well as the footing underneath the stack, receive additional support in the way of piling, on account of the location on the river bank. The self-supporting steel structure is carried on concrete foundation walls and footings. The steel work carries the reinforced cinder concrete roof, the runway for the traveling crane in the turbine room and the reinforced-concrete coal bunkers in the boiler room. The brick building walls are also carried on the concrete foundations, and are built about the steel columns. The roof is of cinder concrete overlaid with composition roofing. Drainage downspouts are taken down through the interior of the building and discharge into the sewer system.

Coal is delivered to the plant in hopper cars, which are run over a wooden trestle leading above the receiving hopper, into which it is dumped by gravity. The coal-receiving hopper feeds directly into the crusher, which has a capacity of about 30 tons per hour, and which acts at the same time as a feeder, delivering the coal at a uniform rate to the vertical bucket elevator extending to the top of the building. From the vertical elevator the coal is fed by chutes onto a conveyor belt, from which it is discharged by an automatic tripper arranged to deliver the coal at any point above the bunkers. Slow-speed induction motors drive the coal handling apparatus, a 20-HP. motor being used in the crusher and a 10-HP. for the operation of the elevator and conveyor.

Coal for firing purposes is drawn directly from the bunkers, through sheet metal chutes, into the stoker hoppers, which are located in front of the boilers. The ashes are drawn from the grates of the boiler furnaces onto the boiler room floor, where clinkers are broken and delivered through a coarse grating into the ash hoppers which are suspended underneath the floor. From the hoppers they fall by gravity through ash grates into the push cars, and are dumped into an ash chute connecting with the coal elevator. The elevator, when handling ashes, discharges into a spout leading to a small ash bunker at the end of the building. From this bunker they can be delivered by gravity into cars alongside the power plant.

The generating plant consists of two Parsons-Westinghouse turbo-generators, designed to operate at a normal voltage of 3,300 volts, with a frequency of 25 cycles per second. They are three-phase machines, but are required by the specifications to furnish their full rated load of 1,250-KW. single-phase current. The turbines are approximately 37 ft. over all, 6 ft. in width, and 8 ft. high, designed to operate at 1,500 r. p. m. The generators are cooled by means of air drawn through the coils by vanes installed on the rotor. A speed-limit device is arranged to cut off the supply of steam in case the speed of the turbine exceeds a predetermined value. There are two steam-driven exciters of 25-KW. capacity each. There are four water-tube boilers of 400-HP., with flues leading to a Weber reinforced-concrete chimney, 150 ft. high above the flues. The boilers have under-feed stokers and work under forced draft supplied by fans. The condensing water is taken from the river, and the feed water from the city mains. The generating plant consists of ten Parsons-Westinghouse turbo-generators.

CONSTRUCTION AND OPERATION OF THE ELECTRIC SYSTEM.—The entire electrical equipment has been in preliminary operation during the larger part of the year 1908. The work of construction was done without any material interference with the traffic through the tunnel. The greatest difficulty was experienced in carrying out that part of the installation located in the tunnel proper. For this purpose the tunnel was given over to the contractor for construction purposes for two two-hour periods each day during the time that actual construction was in progress in the tunnel. The construction of the overhead work in the yards was carried out without any serious interference with the ordinary traffic of the road, and the power plant construction was not subject to any interference on account of railway operation.

The problem of transferring the operation from steam to electricity gave rise to another problem which was successfully solved by the mutual cooperation of the representatives of the railway and the contractor. No attempt was made to make a sudden transfer, but every precaution was taken, not only to thoroughly test out all electrical equipment before using it in regular service, but also to allow ample time in which to thoroughly familiarize all those connected with the operation of the equipment with their work.

Locomotive enginemen were trained in the use of the electric locomotives. The force required for maintenance of the locomotives and for maintenance and operation of the power plant were secured and assigned their duties during the time that the first experimental and test runs were made with the equipment. When everything was in readiness, test runs were made with locomotives alone. Moderate-size trains were then taken through the tunnel as test loads, and finally a limited number of regular trains were handled by the electric locomotives.

In this way, by gradually increasing the amount of work done by the electrical equipment, the entire operation was transferred from steam to electricity. No delays worthy of notice occurred, either during partial operation, or during the time of preliminary electric operation.

COALING BARGES AT HAVANA, CUBA.

By E. H. SANBORN.*

The type of coaling barge shown by the illustrations has been developed by the Havana Coal Co. to meet the peculiar conditions under which steamers are coaled at Havana, Cuba. All coaling is done in the stream, and as steamers are usually surrounded by small lighters receiving and delivering freight, it is rarely possible to place the fueling barge broadside to a steamer. This necessitates the delivery of coal from the bow of the barge. (See Fig. 1.) As the barges are loaded from a dock by bridge tramways, it is necessary that they shall have no obstructions above the deck to interfere with the grab buckets or the aprons of the tramways.

For many years the company has used a number of fueling barges, equipped with chain and flight conveyors running in an inclined trough rising from deck level at the stern to a high A-frame at the bow, and there discharging into a swinging telescopic chute. As an improvement upon this system the company has equipped several barges with the arrangement shown in the illustrations, and two years of operation have demonstrated the efficiency of the equipment. Upon the bow of the barge there is a wooden tower 55 ft. high, through which the coal is elevated for delivery into the steamship bunkers.

In the latest type now being built the wooden tower is replaced by a light steel one of the same height. These barges were built by Quigley, Davis & Dorp, of Camden, N. J.

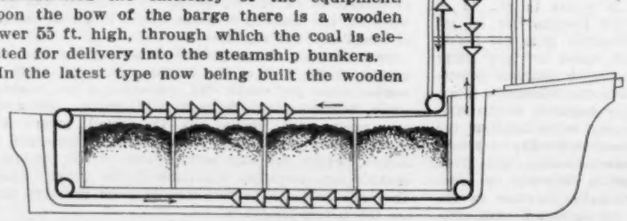


FIG. 2. CONVEYOR DIAGRAM OF HAVANA COALING BARGES.

The conveyor (made by the Link-Belt Co.) consists of V-shaped buckets, 20 x 20 ins., attached at intervals of 36 ins. to two strands of steel roller chain running noiselessly between steel guides in a steel trough about 100 ft. long, built alongside the keelson of the barge and below the level of a false deck. The conveyor dumps at the top of tower on the forward side into the hopper of a 60-ft. telescoping chute 15 ins. in diameter. With this chute the barge has a range of delivery from the water line to a bunker hatch 40 ft. above. The conveyor returns down the after side of the tower and along the deck, where it is covered by a steel plate roof to deflect lumps of coal when the barge is being loaded. The conveyor travels at a speed of 120 ft. p[er] min., and can deliver 100 tons of coal per hour run continuously, which, however, is rarely [po]ssible, as trimming in the bunkers necessitates intermittent operation. The conveyor is dri[ven] by a 35-HP. engine, located at the base of the tower. This large power is required by the frequent starting of the conveyor under full load. Coal is fed into the conveyor through steel chutes on the bulkheads, which divide the hull into four compartments, having an aggregate capacity of about 750 tons. Two chutes bolted to the bulkhead are needed for each compartment and lead down directly to the conveyor. Ordinarily two or

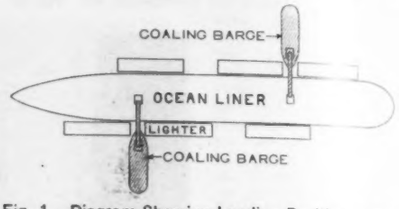


Fig. 1. Diagram Showing Loading Position of Coaling Barges at Havana, Cuba.

three men are required at a chute. Movable plates on the faces of these chutes are taken off as the level of the coal is lowered, and when the bottom is reached loose planks are removed from the conveyor trough. The details of these chute plates are shown in Fig. 4.

The port of Havana enjoys a reputation for rapid bunkering of steamers by these barges, and vessels calling at that port for coal only are fueled at a rate approached in few other ports in the world. Four fueling barges are often used to coal a single steamer, putting into the bunkers as high as 1,200 tons in eight hours. Ordinarily two barges to a steamer are sufficient.

CALCIUM CHLORIDE AS A PREVENTATIVE OF FREEZING IN AUTOMATIC SPRINKLER SYSTEMS.*

RUTGER B. GREEN,† M. Am. Soc. C. E.

In the protection of factories against fire by the automatic sprinkler system, a herring-bone system of small water pipes is spread over the ceiling with fusible sprinkler heads distributed so that each head protects an area of about 100 sq. ft. of ceiling above and floor below. These heads are usually designed to melt at a temperature of about 150° F. so that any fire starting beneath them and causing them to attain that temperature is automatically quenched by a jet of water released from the pipes through the melted sprinkler head.

In cold buildings these water pipes are apt to freeze; to prevent which, it has been customary to fill the pipes with compressed air, an air valve being placed in the main water-supply pipe just below the freezing line. The air valve may be underground or in a room sufficiently warm at all times to prevent the freezing of the water pipe just below the valve. This air valve, which is really a check valve against the air and separates the air-filled part of the piping from the water-filled part, has to be designed with a large air-area opposed to a small water-area so that it is necessary to furnish an air pressure of only one-quarter or one-third the water pressure; the idea is that when a sprinkler head is melted by fire under an air-filled system, the more air there is in the pipe, the longer it takes the water to push it along and reach the fire, a few seconds' time often being of great importance in what is called a quick fire. To this objectionable delay in the use of compressed air there has been added the high first cost of the air-valve, the care needed to keep it in good order, its taking up three or four times as much room as the water-main, and the fact that compressed air is not always available at isolated buildings. Again, an air leak in a piping system is very difficult to find so that electrical

*Treasurer, Havana Coal Co., Philadelphia, Pa.

*Repriated from the "Cornell Civil Engineer," October, 1908.

†The Solvay Process Co., Detroit, Mich.

alarms and constant watchfulness of the air valve are needed to prevent the air leaking out and water following it out in cold weather, when a freeze-up would be very expensive in itself as well as dangerous in case of a fire at the same time.

The mixture in which the writer has had charge of the fire protection make carbonate of soda from salt and limestone, the sodium chloride and calcium carbonate being broken up and reunited into sodium carbonate and calcium chloride, the latter being regarded as a by-product. In solution, calcium chloride is much heavier than water, slow to boil and slow to freeze, strong solutions being able to withstand temperatures as low as 30° below zero. Its general introduction as a non-freezing solution for the water-jackets of automobiles some years ago suggested its use as a substitute for compressed air in exposed automatic sprinkler systems. The insurance companies, when asked for approval of this innovation, raised the question of expansion. The coefficient of calcium chloride is high, so that as the check valve prevents the expansion's finding relief back in the water main, it might send the pressure on the sprinkler system up to bursting point and cause as much damage by water as a fire would. Various arrangements were suggested to take care of this expansion, the most prominent being air-chambers, relief valves, and a U-seal arrangement of the supply main to take the place of the check valve in preventing the heavy calcium chloride from working back into the main. Recent experience in rail welding having shown that the expansion in the rails of street railway tracks has a way of taking care of itself when the rails are laid too close to allow of longitudinal expansion, an experiment was tried with two sprinkler systems, one building being equipped with an expansion air-chamber, and another unimportant building without any expansion device at all. The elaborate air valves were then replaced with simple check valves, and a strong solution of calcium chloride was pumped in. A year's test showed that the expansion took care of itself as in the railroad rails. Evidently a network of small piping has considerable elasticity which is helped by the trapping of small quantities of air in the piping when being filled with the calcium chloride, and by small leakages back through the check valves, very few of which will not leak a little.

In filling a sprinkler system with calcium chloride on the approach of cold weather, it is first necessary to drain all the fresh water out from above the check valve, as the calcium chloride is so much heavier than water that any water remaining in the pipe will be floated up into the small piping under the higher roofs, where it may freeze before it has had time to combine with the calcium chloride solution. This drainage is done through the customary drip-pipes provided in the air system, where it is even more important to get all the water out of a system before pumping in the air. Again, in very cold buildings, care must be taken to let the air out of the high points of the piping system as the calcium chloride is pumped in. Otherwise, any large quantity of air trapped in the pipes will leak out so slowly as to be unsuspected and thus make room for fresh water to enter through the check valve and possibly for the calcium chloride to pass out. The air is very readily let out through vent cocks or by unscrewing an occasional sprinkler head itself. This precaution is rendered less important from the fact that the check valve is usually placed in the large supply main, which is less liable to freeze than a small pipe, and also has so much calcium chloride in it that fresh water getting through the check valve is taken up in the solution before it can freeze.

This substitute for compressed air has been used for four winters successfully in unheated warehouses in Detroit.

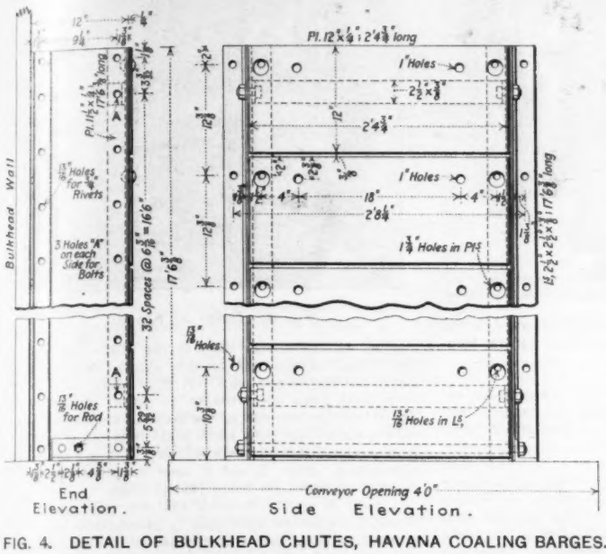


FIG. 4. DETAIL OF BULKHEAD CHUTES, HAVANA COALING BARGES.

MEETING OF THE AMERICAN PEAT SOCIETY.

The American Peat Society, the formation and first meeting of which was noted in Engineering News, Oct. 31, 1907, held its second meeting at Toledo, Ohio, Oct. 22, 23 and 24. In the absence of the president, Dr. Joseph Hyde Pratt, of Chapel Hill, N. C., Prof. C. A. Davis, of Ann Arbor, Mich., presided. At the first session current progress in the utilization of peat was taken up by representatives from the different sections of North America.

Mr. Otis E. Moulton, of Dover, N. H., described the various attempts made in Maine, Massachusetts and New Hampshire, and expressed the conviction that a respectable peat industry would spring up in New England in the coming season. Mr. Carl Kleinstueck, of Kalamazoo, Mich., reporting for the Northwest, stated that he had received numerous inquiries and had visited Mason City, Iowa, to examine some excellent bogs there. As a result of that visit, a plant had been established and it had successfully operated all summer. His own plant was reported as working at full capacity with a market for three times the amount of fuel produced at $5 per ton.

Mr. Erik Nystrom, of the Canadian Bureau of Mines, gave a brief report, stating that he knew of only two places where they were actually making peat-fuel in Canada. Many companies have been formed, but nothing further has been heard from them. The government, it was said, has been interested in the matter of peat development, and some surveys of different peat bogs have been made by the Bureau of Mines, which will establish a peat gas and power plant for experimental purposes during the coming year.

FIG. 3. COALING BARGES OF THE HAVANA COAL CO., HAVANA, CUBA.

Dr. J. McWilliam, of London, Ontario, also reported on Canadian activities, and dwelled upon a process for briquetting and on the use of peat dust for boiler fuel. (These processes were described in our report of the first meeting of this society, Oct. 31, 1907.) Mr. F. J. Bulask, of Toledo, spoke on the work in the vicinity of Toledo. His peat-fuel plant was reported as hampered in its development because of lack of transportation facilities, but the delay gave time for experimental work in various directions. He emphasized the great need for a practical dryer for artificially drying peat-fuel.

On recommendation of the Committee on By-Laws and Resolutions, the annual membership fee was fixed at $3.00 and the associate grade of membership was abolished.

Prof. C. A. Davis was elected as an honorary member. It was voted to enroll one directing official of each European peat society as an honorary member.

Boston was selected as the place for the next meeting, in September, 1909. It is proposed to arrange a comprehensive exhibition, at this time, which will show the many uses of peat and the machinery and plants necessary for transforming the peat in the bog into a marketable product.

The following officers were elected for the coming year:

President, Joseph Hyde Pratt, State Geologist, Chapel Hill, N. C.

Vice-Presidents: (1) Eastern States, Marion R. Campbell, U. S. Geological Survey, Washington, D. C.; (2) Great Lakes and Mississippi Valley, Carl Kleinstueck, Kalamazoo, Mich.; (3) Southern States, Robert Ranson, Crescent City, Fla.; (4) Pacific States, Prof. J. G. Scrugham, Univ. of Nevada, Reno, Nev.; (5) Canada, Dr. J. McWilliam, London, Ontario; (6) New York Section, Prof. F. R. Stevens, Skaneateles, N. Y.; (7) New England Section, E. C. McKenney, Devonshire Bldg., Boston, Mass.

Secretary-Treasurer, Julius Bordollo, Kingsbridge, New York City.

The following list of papers were presented for discussion:

(1.) "Commercial Aspect of Gasifying Peat," by Mr. Robert Schorr, San Francisco.

(2.) "Utilization of Peat," by Dr. Samuel S. Jodidi, Agricultural Experiment Station, East Lansing, Mich.

(3.) "Peat and Swamp Land," by Mr. Joseph Hyde Pratt, Chapel Hill, N. C.

(4.) "Life in a Michigan Peat Marsh," by Carl Kleinstueck, Kalamazoo, Mich.

(5.) "Peat in Ireland," by Mr. Herbert Garnett, Eaton Rapids, Mich.

(6.) "Briquetting of Peat," by Mr. Otis E. Moulton, Dover, N. H.

(7.) "Latest Developments in Peat Gas Producers," by Dr. Otto Zwingenberger, New York City.

(8.) "Peat in Indiana," by Mr. A. E. Taylor, Findlay, Ohio.

(9.) "Artificial Wood Made from Peat," by Mr. F. Schuenemann, St. Louis, Mo.

(10.) "Latest Peat Researches of the United States Geological Survey," by Prof. C. A. Davis, Ann Arbor, Mich.

The majority of these papers considered one phase or another of making peat gas, although there were important discussions on peat drying and the recovery of nitrogen for fertilizers. It was stated that at the Fuel-Testing Plant of the U. S. Geological Survey in Pittsburg, and at the Canadian Bureau of Mines, Ottawa, peat power-gas plants would soon be installed.

The Commercial Artificial Fuel Co. gave a dinner to the society on one evening of the convention and on the following day the members inspected the plant of this company, about 18 miles from Toledo. This plant is one of the largest and most successful peat projects in America.

INDUSTRIAL PHOTOGRAPHY.*

By E. ASHTON HAND,† M. Am. Soc. M. E.

Photographs of machinery, interiors of shops, products of machines, processes of manufacture, etc., are generally made to aid the selling department of an establishment in disposing of its product.

Sometimes the photographs themselves are used as an advertising medium, but in the majority of cases half-tones are made from them for use in catalogs, or for illustrations in trade journals. Catalogs have of late years developed into veritable works of art, and their preparation calls for photographic work of the highest order.

To this end it should be the aim of the photographer to produce prints that will require the least retouching when used for making half-tones, and this for two reasons: First, the retouching of prints for half-tone work is quite expensive; and second, the print that requires the least retouching gives much the best results in the finished half-tone. A print which requires very little retouching to produce a first-class half-tone is a good one for all other purposes, but a print good enough for all other purposes may be a very poor one from which to produce a half-tone.‡

Nearly all industrial establishments are equipped with a photographic outfit of some kind, and in some instances an experienced photographer is in charge; but in the majority of cases one of the draftsmen must take care of all the photographic work of the establishment, and it is in the hope of aiding some of the latter that this paper has been prepared.

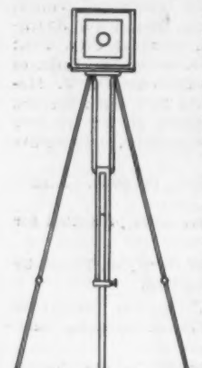


Fig. 1. Tripod with Triangular Base.

APPARATUS.—The camera should be a strong and serviceable one having a long bellows with very little cone. In fact, one with a perfectly straight bellows is best, as it allows greater adjustment of the lens board without danger of the bellows folds cutting off any of the object. The vertical and side swings should be ample.

The camera need not be larger than 6½ by 8½ ins., and should not be larger than 8 by 10 ins., as anything over this size is cumbersome to handle, and requires a very expensive lens, and a great deal of skill to operate.

If large prints are wanted, bromide enlargements can be made up to any reasonable size, and if for any reason large direct or contact prints are wanted, a slightly enlarged positive can be made from the negative, and a negative as large as wanted can be made from the positive. This procedure has its advantages, as it is often possible to correct in a great measure any errors in exposure or development, and many errors in lighting and position.

The writer never uses a camera larger than 6½ by 8½ ins., and has produced many excellent enlarged negatives up to 24 by 36 ins., by the method above mentioned.

The tripod should be solid and stiff with the fewest possible joints. An excellent thing for use with it is a triangle with sides about 36 ins. long, and with a roller or caster under each point as shown in Fig. 1. With the tripod mounted on this arrangement, the camera can be moved any distance or in any direction without material change in level.

The lens should be the best obtainable, and too great emphasis cannot be placed on its being of long focus. Never under any circumstances should its focus be shorter than the diagonal of the largest plate with which it is to be used. It should be capable of rendering sharp definition from corner to corner of the plate when using a comparatively large diaphragm. A lens of this character will render the focusing much easier, and will enable the exposure to be made in the shortest possible time.

The plates should not be the most rapid made, as the emulsion with which these are coated is not generally rich enough in silver to give printing density for anything but portrait work, and also because the timing of the exposure must be very exact. Unless both exposure and development are just right, the negative will not be "snappy" enough to produce a good bright print.

Very slow plates take long exposures, and unless skilfully handled in development will produce prints with entirely too much contrast. Plates of medium speed are the best and should be of the kind known as "double coated" or "non-halation." Plates of this kind are first coated with a slow emulsion, and after drying are again coated with a somewhat faster emulsion. Plates so coated allow of very great latitude in time of exposure.

If interior views are to be made where windows and other openings to the light have to be faced, then the plates should be coated on the back with a compound known as "backing." This will prevent to a great extent halation or blurring of the high lights caused by reflection of light from the surfaces of the plate under the emulsion. This "backing" should be washed off with a damp sponge before development.

PREPARATION OF THE SUBJECT.—If a machine is to be photographed, it should be painted with a finishing coat of drab paint, which may be designated as "mouse color," and the paint should be so mixed as to dry absolutely "flat," that is, without any gloss whatever. If parts underneath the machine or in shadow are wanted to be shown, they should be painted a lighter shade than the more prominent parts, and the deeper they are in shadow the lighter they should be painted, even in extreme cases blending the color gradually into a white. All brightly polished parts should be daubed or rubbed over with a handful of soft putty to dull the brightness.

Unless these precautions are taken, the parts in shadow will show very dark in the photograph, and if very close together will be seen only as one shapeless mass, and the bright spots will show chalky white with very black lines and little or no detail. If letters or figures cast on any part of the machine are wanted to be shown, daub them with white paint from the end of the finger. Rubbing with chalk will give them a very rough appearance. Figs. 2 and 3 show machines that were properly prepared for being photographed.

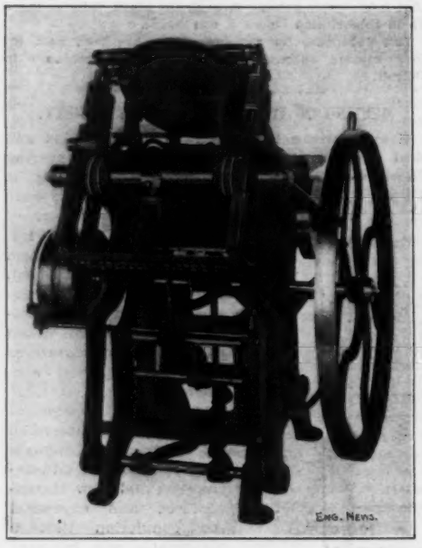


Fig. 2. Details Brought Out and Shadows Avoided by Preparation of Machine Parts before Photographing.

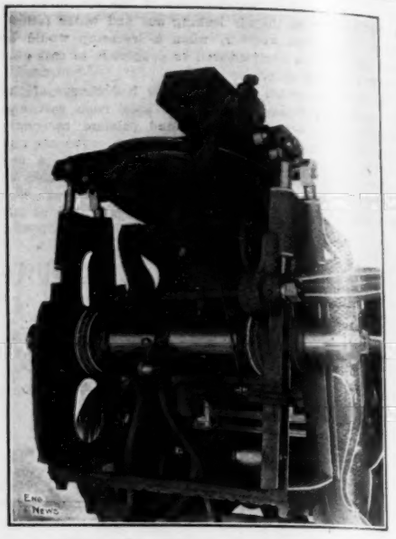


Fig. 3. Detail of Fig. 2.

It must be borne in mind that all high lights and shadows are greatly intensified in photography, and that a sensitive plate that will register all the gradation of tone as seen by the human eye has yet to be made.

If possible, it is best to photograph a machine before it has been run, otherwise oil from the bearings will seep out on the paint and leave dark and glossy spots which will look badly in the photograph. If the machine is to be run before being photographed, then it should not have its finishing coat until after the run or test is over. Before the finishing coat is put on, all the bearings should be thoroughly flushed with gasolene and the whole exterior cleaned with the same stuff to remove all oil.

LIGHTING AND POSITION.—Machinery should never be photographed out of doors or under a skylight, as there is too strong a top light which causes deep shadows. The light should preferably come from the north, and should fall on the machine at a downward angle of about 20° from the horizontal. Cross lights from other windows should be avoided by pulling down the shades or tacking up heavy paper. Cross lights make a confusion of shadows and obliterate certain lines, giving the machine anything but a natural appearance. If necessary to photograph the machine by other than northern lighting, then make the exposure when the sun is overhead. If the exposure must be made when the sun is shining through the windows at any considerable slant, tack cheese cloth over the windows to diffuse the light.

A machine should never be photographed directly from the front, which will make it appear too flat. For depth, the camera should be placed enough out of center to

Fig. 4. Distorted View Made by Pointing the Camera Upward.

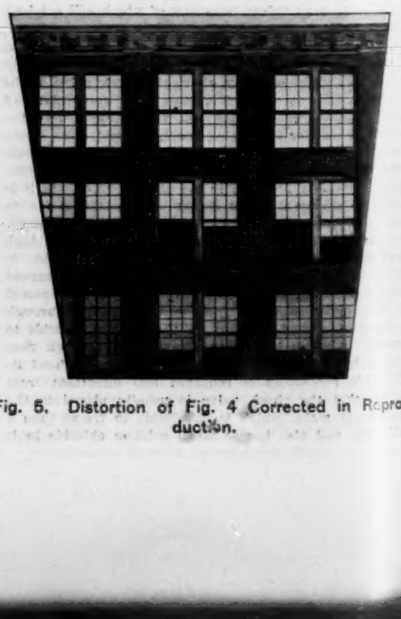


Fig. 5. Distortion of Fig. 4 Corrected in Reproduction.

*A paper to be presented at the New York Meeting (December, 1908) of the American Society of Mechanical Engineers and printed in the November "Journal" of the society, p. 1344.

†Superintendent, Chandler & Price Co., 6000 Carnegie Ave., Cleveland, Ohio.

‡The reproductions in this paper were made from photographs upon which there was no retouching whatever.

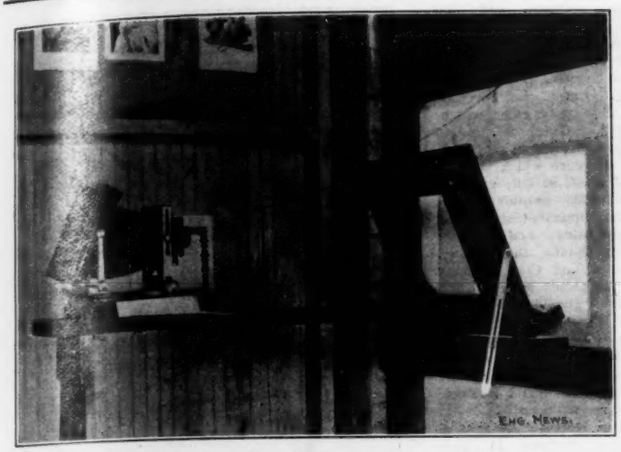


FIG. 6. CAMERA AND NEGATIVE HOLDER ARRANGED SO AS TO CORRECT DISTORTION SHOWN IN FIG. 4.

show a little of one side of the machine and high enough to show a little of the top.

A background of heavy drilling, either white or very light in color, should be hung not less than 6 ft. back of the machine. It should be of ample size—large enough so that the camera can be moved where wanted and still show the background behind every part of the machine. If there are folds or wrinkles in the background, have a man at each side take hold of the edges and shake the curtain slowly and gently during the whole time of the exposure. This will prevent the folds or wrinkles from showing in the photograph.

Shop floors are dark in color, and if a machine is photographed directly on the floor it is often puzzling to know where the lower part of the machine ends and the floor begins. Therefore a floor cloth of the same color and width as the background should be used. It should be deep enough to extend from 4 to 6 ft. in front of the machine and under it and to the background. This will define the lower parts of the machine, and also reflect the light upwards, softening the shadows. Instead of a floor cloth, sheets or strips of light colored paper can be used, but be sure there is no pronounced red or yellow, as such colors are non-actinic and will show black in the photograph.

FOCUSING.—Never focus on the center of the ground glass, as this will give you the point of sharpest focus of the lens and what is wanted is the average focus; therefore focus at a position midway between the center and the edges of the ground glass. Get the nearest parts of the machine in focus. Small diaphragms will sharpen the distant parts.

Sometimes a better effect can be obtained by pointing the camera slightly downward, but if at any time the camera is used in any other than a level position, the ground glass should be brought to a vertical position, otherwise the result will be distorted lines.

Fig. 4 shows a distorted view of a part of the side of a building, made by pointing the camera upward. If the photograph of a machine shows such distortion, and for any reason it cannot be photographed again, a negative can be reproduced eliminating the distortion, by placing the negative in a frame tilted at such an angle that the narrowest lines are nearest the lens, and making a positive in the camera, tilting the ground glass at an equal angle, but in the opposite direction. A negative can be made from this positive, as shown in Fig. 5, which was actually made from a negative reproduced in the above manner from that used for Fig. 4. Notice how much the top of the negative had to be enlarged to bring the lines parallel.

Fig. 6 shows a camera and negative holder in the proper position for this operation.

If the machine to be photographed is a long one, requiring a raking view, use the horizontal swing to bring that part of the ground glass on which the image of the farthest part of the machine appears, farthest away from the lens. This will even up the focus and make it possible to use a larger diaphragm, shortening the time of exposure, and also extend the vanishing point to a greater distance, giving it a more normal perspective.

If there are perceptible vibrations to the floor on which the photographing is done, get three pieces of harness felt ½-in. thick, and two or three inches square. Place one of these on the floor under each leg of the tripod, and they will absorb all ordinary vibrations and keep the camera steady.

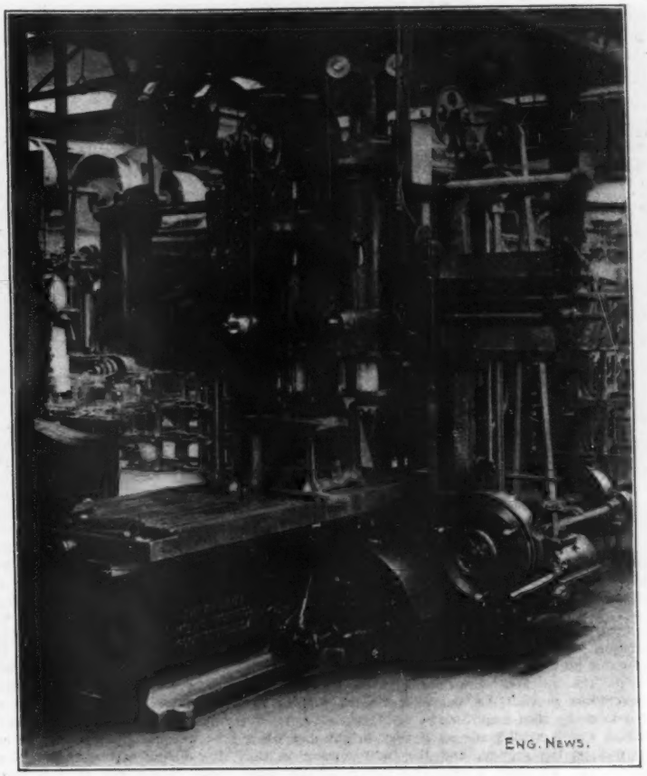


FIG. 7. DETAILS OF A DARK SHOP BROUGHT OUT BY LONG EXPOSURE.

EXPOSURE.—Exposures should always be ample, as an under-exposed plate can never be made to show that which the light has not impressed upon it (although it can be greatly helped by skilful development), but a moderately over-exposed plate can easily be treated in development, or even afterwards, so as to yield a first-class print. Fig. 7 is an illustration of details brought out by long exposure in the dark part of a shop.

If in doubt as to the correct time of exposure, make a guess as near as possible. Suppose your guess to be four minutes, then put a loaded plate holder in the camera and draw the slide so as to expose two inches of the plate and make an exposure of two minutes; cap the lens, draw the slide out two inches more, and make another exposure of two minutes. Repeat this, drawing the slide two inches at a time, until the whole plate has been exposed.

If the plate is an 8 by 10, there will be five parts having respective exposures of 10, 8, 6, 4, and 2 minutes each. Develop this plate, and it will be easy to tell which part has had the proper exposure, and from the position of this part the time can readily be found.

INTERIORS.—In photographing interiors, avoid pointing the camera towards windows if possible, but if this

FIG. 8. PHOTOGRAPH FROM NEGATIVE TAKEN WITHOUT SPECIAL PRECAUTIONS AGAINST STRONG LIGHT. STRONGEST LIGHT AT FAR END.

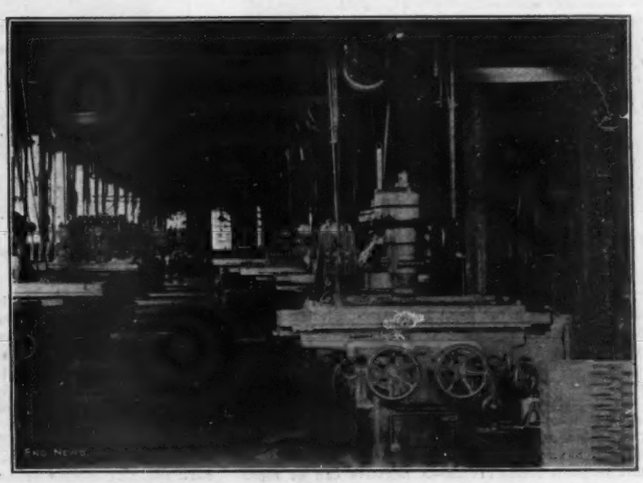


FIG. 9. SAME CONDITIONS AS IN FIG. 8, BUT WITH STRONG LIGHT IN FOREGROUND.

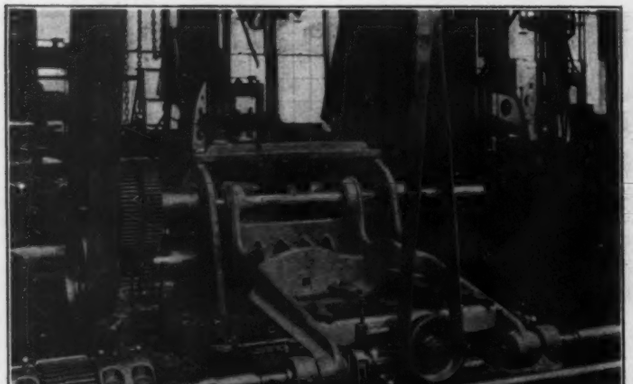


FIG. 10. PHOTOGRAPH ON SAME DAY AS IN FIGS. 8 AND 9. CAMERA POINTED DIRECTLY TOWARDS THE LIGHT.

cannot be avoided, then cover the windows with heavy drilling or thick wrapping paper, fastening it well around the edges, so that no bright margins of light are visible. After the exposure has been made, the window coverings can be removed and an additional exposure of a fraction of a second can be given. This will give the windows a natural appearance and will often show objects on the outside. Interiors can be photographed without these precautions, but skilful work will be required to make good negatives.

Figs. 8 and 9 were made on a very bright day when snow was on the ground, and the light coming in the windows was intensely white. As the negatives were wanted in a hurry, no precautions were taken to soften or stop out the light at the windows. The far end of Fig. 8 was a southern exposure, and the sunlight was streaming in at the windows. Fig. 9 is a view in the same room taken from the south end, where the light was so intense that the milling machine in the foreground appears light in color, although it was painted a dark steel color.

Fig. 10 shows work in process in a special machine. This was made on the same day as Figs. 8 and 9, and with the camera pointed directly at the light. To work successfully under such conditions, the photographer must know to a nicety just how long a certain kind of plate may be exposed before halation takes place, and just how to get the best results in development from the shortest permissible exposure.

COPYING.—In copying drawings or other subjects in black and white, it is necessary to use a very slow plate, give the shortest possible exposure, and use a concentrated and well restrained developer. Unless this is done, the lines of the drawing will not be clear and sharp.

If a copy is to be made from a blueprint, it will be necessary to bleach the print in a weak solution of ammonia and water, and after a thorough washing, to immerse it in a weak solution of tannic acid. The part that was formerly blue will now be a rich purplish brown. The necessity for this treatment is that blue is an actinic color, and a negative made from such a print will have very little contrast; while brown is a non-actinic color, and a negative made from a print of that color will have plenty of contrast.

ENLARGING NEGATIVES.—A negative can be reproduced in a larger size by first making a positive in the copying camera, and then making a large negative from the positive by the use of the same instrument.

If a negative is enlarged to many times its original size, a granular effect will be noticed. This is caused by magnification of the emulsion structure which is made up of countless hills and valleys. This granular effect can be eliminated by slightly over-exposing and greatly over-developing the original negative, and then reducing it to the proper density. The positive should have the same treatment.

Reduction does three things:

(a) It reduces or clears the shadows faster than the high lights. Therefore over-exposure is resorted to in order to increase the density of the shadows in proportion to the high lights, so that they shall bear proper relation to each other after reduction.

(b) It thins the density of the negative or positive. Therefore over-developing is resorted to in order to have resulting density after reduction.

(c) It cuts down the hills to the level of the valleys, so that very little if any granular effect is noticeable when the emulsion is magnified.

In reproducing negatives either in the original or a large size, there is a splendid chance for what may be termed "jockeying." A brilliant negative may be made from a very flat one, and vice versa; errors in perspective can be corrected by the method shown in Fig. 5; unequal lighting can be corrected by judicious shading during exposure, and various "stunts" that will suggest themselves to the ingenious mind can be performed.

X-RAY OR GHOST PHOTOGRAPHS.—When an illustration is wanted to show clearly some hidden interior part of a machine in relation to and more distinctly than other parts, the usual procedure is to have a wash drawing made in India ink, from which the half-tone is produced. This method is always expensive, and the results are often very unsatisfactory.

Fig. 11 shows a power-driven machine for cutting paper, in which the power is transmitted through worm gearing and a positive clutch, all of which is enclosed in an oil tight case, as shown at the lower lefthand part of the machine. An illustration showing the worm and worm wheel in mesh was wanted.

An engraver was called in, who said he could do the job in a satisfactory manner. Blueprints showing both details and construction were furnished him as a guide to size and shape of the various parts, and their appearance when assembled. After repeated attempts, his results were not satisfactory, and it was decided to rely entirely upon photographic methods for the illustration.

The case and its contents were removed from the machine and mounted on a box. The upper part of the case was taken off, leaving the worm wheel and the clutch collar exposed to view. The worm and shaft were removed from the upper part of the case and placed in their proper position in relation to the worm wheel, as shown in Fig. 12. A dark background was placed in the rear and an exposure was made. After the exposure the cap was put on the lens, the worm and shaft taken away, and the upper part of the case put in position as in Fig. 13. A light background was substituted for the dark one, and another exposure made on the same plate, the result of which is shown in Fig. 14.

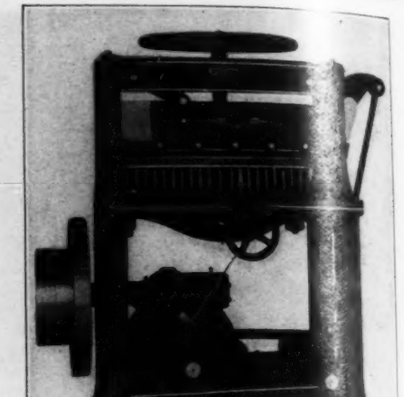


Fig. 11. Photograph of Paper-Cutting Machine, Showing Clutch Mechanism to be Brought Out by Photographic Methods.

DEVELOPMENT.—Of the art of development much has been written, and more has been said, but the fact remains that the only adequate teacher is experience. A few hints, however, concerning the behavior of certain mixtures of developer, may be of service.

(1) Too weak a developer makes a flat thin negative. (2) Too concentrated a developer makes a negative with too much contrast. (3) Under-developing makes a negative lacking in printing density. (4) Over-developing makes a thick dense negative requiring a very long time to print. (5) An under-exposure should be developed with a diluted developer. (6) An over-exposure should be developed with a concentrated developer well restrained with bromide of potash. (7) Developers, like artists' colors, should be mixed with brains. (8) Choose a moderately slow developer, learn how to use it, and don't let any one persuade you to change it.

PRINTING.—Printing can be done in so many ways and on such a variety of papers, and the solutions necessary for developing and toning require such care in compounding and handling, that it can in most instances be better and more cheaply done by a professional.

PUBLIC IMPROVEMENTS, accepted by the voters in the recent election, include the construction of a deep waterway from Lockport to Utica, Illinois, along the Illinois River as a part of the 14-ft. waterway from Chicago to the Mississippi River. This will cost $20,000,000.

The voters of Pittsburg decided to increase their bonded indebtedness by $4,430,000 for six projects: $1,000,000 for a bridge over the Allegheny at the Point; $240,000 for rebuilding the Larimer Ave. bridge; $2,675,000 for the purchase and extension of the works of the Monongahela Water Co.; $50,000 for a bridge over Negley run, from Everett to Omega St.; $185,000 for rubbish-disposal plants; and $300,000 for laying water mains in the East End section.

Baltimore ratified a loan of $5,000,000 for transforming the valley of the Gunpowder River into a storage basin with a capacity of 20,000,000,000 gals.

San Francisco on Nov. 12, by a vote of 6 to 1, decided to build a new municipal water supply and bring water from the Sierra Nevada Mountains.

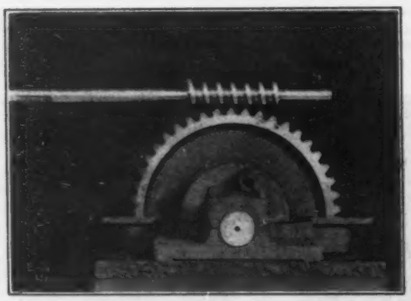


Fig. 12. Photograph of Worm and Gear, with Upper Part of Case Removed.

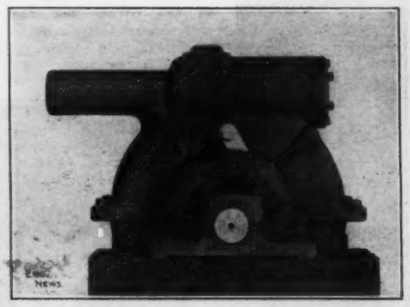


Fig. 13. Exterior of Case to be Photographed on Same Plate with Fig. 12.

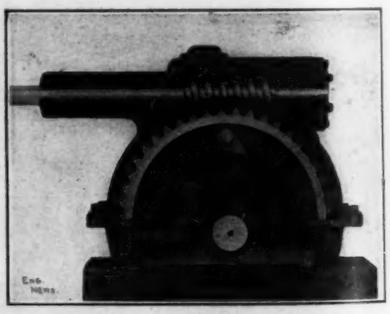


Fig. 14. Result of Exposures Figs. 12 and 13 on Same Plate.

STEEL AND CONCRETE TIES IN EUROPE.

The use of steel and concrete ties for light and local railways was discussed in a report on track construction presented by Mr. C. de Burlet, of the Belgian Local Railways Co., at the convention of the International Union of Street and Interurban Railways, held at Munich in September. Of 69 companies of the class mentioned, 47 use wooden ties exclusively, 7 use steel ties exclusively, 13 use both wood and steel (2 using steel only at switches), and 2 use both wood and concrete.

The steel ties in all cases are of the inverted trough section, some having horizontal ribs at the ends of the flanges, and the ends are closed in order to retain the ballast. The ties for meter gage tracks are from 5 to 6 ft. long, weighing from 33 to 90 lbs. The ties for standard gage tracks are from 6½ to 8¼ ft. long, weighing from 97 to 115 lbs. The cost of the ties for standard gage tracks varies from $1.60 to $2.40 (according to their weight and to the condition of the steel market). On all but four of the railways, the rails rest directly upon the ties, and are secured by clamps with keys or bolts. The inward inclination of the rails (which is the universal practice in Europe) is obtained by bending the tie.

The results of the steel ties are satisfactory, except on two lines which intend to abandon them. The fastenings are considered to be more reliable and secure than with wooden ties, thus increasing the safety of traffic. The maintenance work upon the track is, as a rule, more difficult but less frequent attention is required than with wooden ties.

Reinforced-concrete ties are used by the Hamburg street railways and the Voiron & St. Beron Ry. The Hamburg lines are of standard gage. Their concrete ties are 7.2 ft. long, weigh 308 lbs. and cost $1.50. The concrete is composed of 33% cement and 66% sand or gravel. The reinforcement consists of five ⅝-in. round bars near the top surface. The ties are of rectangular section 6 × 8 ins., but the rail seats are raised so that the depth is 8.4 ins. at these points. This is done to bring the rail to the proper level for the paving. Each rail is held by clamps on a U-bolt which is set diagonally to the tie, and has a bearing plate placed between its horizontal leg and the base of the tie. The ties were laid in 1906, and are considered superior to wooden or metal ties. Their great weight gives them stability, the rail fastenings are more secure and cause less wear, and the ties can be used without any special support or foundation. They are expected to have a much longer life than wooden ties.

The Voiron & St. Beron Ry. has had 400 Gilland concrete ties in use since 1903. They have given satisfactory results and promise to have a long life. The line is of meter gage. The ties are rectangular, 5½ × 7¼ ins., 6 ft. long, with a weight of 230 lbs. They cost $1 each. There are three reinforcing frames, each consisting of a steel bar bent to form an upper and a lower member with diagonal members between them. There is also a coil of wire around each hole for the fastenings, with a metal sleeve or thimble in the top of the hole. At each rail seat there are two tapering holes, each filled solid by a pair of semicircular wooden wedges driven in from the bottom. The screw spikes are driven into these, the mushroom heads of the spikes bearing upon the rail base.

THE FREIGHT-CAR SITUATION on Oct 28 was almost identical with that on Oct. 14, the last previous report. The Car Efficiency Committee of the American Railway Association finds that on Oct. 28 there were 110,012 idle cars (against 115,036 two weeks before), a decrease of 4,124. Box cars showed a slight increase in surplus, 39,383 as against 38,878. Flat cars also show increased surplusage. The improvement was in coal, gondola and hopper cars, which decreased from 37,556 to 31,541, a change of 6,015 cars. There are still counterbalancing shortages of about the same amount as two weeks ago, 8,000 cars, as before chiefly on the northwestern and Canadian lines. A decrease of 14,000 in the cars held in repair-shops is also reported for the two weeks, so that the effective increase in utilized cars is about 18,000.

THE REPORT OF THE PENNSYLVANIA WATER SUPPLY COMMISSION: FORESTS, STREAM FLOW AND FLOOD CONTROL.

The annual report of the Pennsylvania Water Supply Commission, recently issued, contains a considerable amount of interesting information bearing on the current discussion relative to river regulation in the United States, with respect to flood prevention and also with respect to the effect of forests upon the flow of streams. The Commission is made up of three men appointed by the Governor, together with the Commissioner of Forestry and the Commissioner of Health, *ex-officio*. Mr. John Birkinbine, of Philadelphia, is the Chairman, Mr. Henry M. Brackenridge, of Pittsburg, is the Vice-Chairman, and Mr. Farley Gannett, of Harrisburg, is the Commission's Engineer. The report makes a pamphlet of 88 pages, and many engineers will doubtless desire to secure copies for their private libraries. Space permits us in the following review to touch only upon the points of special interest with relation to the subjects referred to above.

The fourth chapter of the report is entitled "Deforestation and Its Effect on Stream Flow," and the Commission here and elsewhere definitely accepts the theory that the removal of forests has a marked effect upon the prevalence of floods and the diminution of the streams in times of drought. It is admitted, however, that opinions on this matter rest more upon general observation than on extended measurements of scientific accuracy. The Commission points out that reliance upon personal observation is a doubtful guide, as few persons now living are familiar with the conditions that obtained when the original forest cover still existed.

The Commission prints tables showing the total rainfall, run-off and evaporation on the watershed of Perkiomen Creek from 1883 to 1903. This stream has a drainage area of 152 square miles, and has been closely studied for many years in view of its possible utilization as a source of supply for Philadelphia. The table shows that in the years from 1883 to 1893 the average ratio of run-off to rainfall in the Perkiomen watershed was 51.46%, while in the ten years from 1893 to 1903 it was 44.97%. While this apparently shows a smaller rate of run-off in recent years, the change is probably entirely due to chance variations. As illustrating this, it may be said that whereas in the year 1884-5 the per cent. of run-off was 48.3, in 1902-03 the per cent. of run-off was 60.4. It is not likely, moreover, that the changes in forest conditions on this watershed have been such as to materially influence the run-off, although no statement regarding this is made in the report.

Another table is given, from the report of the State Geological Survey of New Jersey for 1881, which presents a comparison of the flow in gallons per square mile from forested and from barren areas in New Jersey. We present the table, as follows:

Months.	Watersheds. Passaic River, forested.	Barren watersheds.
	Av. flow in gallons per sq. mi. of watershed.	
April	597,000	631,000
May	297,000	145,000
June	272,000	139,000
July	207,000	22,000
August	140,000	22,000
September	139,000	23,000
October	129,000	22,000
November	129,000	23,000
December	127,000	.....

It may well be criticised that the two watersheds compared might be of entirely different character as regards subsoil, etc.

A much more convincing and interesting table, herewith reproduced, records the flow of two small streams in Delaware County, Pennsylvania, as measured by Mr. Henry Birkinbine, Engineer of Wayne, Pa. We quote from the report as follows:

Gagings were taken of the two streams at points where the areas above the weirs were in each case one square mile. One stream flowed through woodland, and the other through open but cultivated country. These gagings were carefully taken, at first daily, and afterward two or three times a week, and were practically simultaneous at each stream.

COMPARISON OF FLOW FROM TWO STREAMS OF ONE SQUARE MILE DRAINAGE AREA EACH, ONE FORESTED AND ONE BARREN.*

Date.	Yield from forested stream in gals. per min.	Yield from barren stream in gals. per min.
For month of Aug., 1896..	31.02 to 64.7	13.11 to 37.76
Sept. 6, 1896, after an all night rain	50.10	54.06
Sept. 8, 1896.....	31.02	7.97
Early part of Oct., 1896...	31.02	10.4
Oct. 12, 1896, immediately after a severe rain.....	127	165
Nov. 6, 1896, heavy rain..	61.36	83.22
Nov. 7, 1896, rain.....	50.1	63.30
For month of Nov., 1896...	33.00 to 98.96	25.83 to 192.72
For month of Dec., 1896..	55.69 to 67.95	73.08 to 122.75
January, 1897, two measurements	85.72 to 112.69	73.08 to 122.22
February, 1897, two measurements	98.96	104.88 to 152.94
March, 1897, six measurements	25.83 to 85.72	45.31 to 179.10
April, 1897	88.07 to 119.84	93.84 to 128.16
May, 1897, two measurements	88.97 to 112.69	73.08 to 122.02

*From 1897 report Pennsylvania Department of Agriculture, Bureau Forestry.

From these records it is seen that the extremes of flow were greater from the barren stream, that in the summer or dry weather months the flow was less in the barren stream, and that directly after rains the deforested stream reached a higher rate of run-off and soon fell to a lower rate than that having a forested drainage area.

The Commission concludes, as a result of all its discussion, that forests are of value as regulators of stream flow, reducing floods and increasing the discharge in dry weather. It urges, therefore, throughout the report, that the forests should be preserved and increased because of the greater value of the streams for water-power and for navigation, and because of the value of the forest in preventing erosion and the choking of the streams with sediment.

The sixth chapter of the report is a review of the principal floods which have occurred in Pennsylvania, and particular attention is paid to the great flood of March 14-15, 1907, at Pittsburg. The Commission points out, what has already been shown in these columns: that the extraordinary height of the Allegheny and Monongahela at Pittsburg was caused chiefly by floods in the Monongahela coincident with fairly high water in the Allegheny and one of its tributaries near Pittsburg, the Kiskiminetas. It appears that the heavy rainfall which was the chief cause of the flood extended over only about 26% of the whole watershed tributary to the Allegheny and Monongahela at Pittsburg, and it is evident, therefore, that a storm of considerably less violence which extended over this whole watershed might cause an equal or greater flood at any time.

Concerning the prospects of future flood damage at Pittsburg, the Commission says:

That greater floods may be expected at Pittsburg is suggested by a comparison of the records of the Ohio and Susquehanna rivers. These two streams drain at Wheeling, W. Va., and at Harrisburg, Pa., respectively, 23,800 and 24,030 square miles, areas approximately equal. If conditions of rainfall, forest cover, topography, geology, development and industry were alike in the two basins, flood discharges approximately equal at these two points might be expected. The Susquehanna drainage basin is subject to a rainfall of 41 ins., while the Ohio basin receives 41.2 ins. The topography does not differ essentially, each stream having certain tributaries leading from the glaciated areas and regulated by lakes, ponds and swamps, and both draining the sides of the Allegheny Mountains, through other tributaries.

The records show that the great rain of May and June, 1889, resulting in a run-off at Harrisburg, in the Susquehanna River, of 29.2 cu. ft. per second per square mile, while during the flood of March, 1907, the Ohio at Wheeling reached but 20 cu. ft. per second per square mile. What a discharge of 30 cu. ft. per second per square mile at Pittsburg would mean in damage and loss of life cannot be foretold.

Concerning floods in the Delaware River, it is stated that on Jan. 8, 1841, this river had a discharge at Lambertville, N. J., of 254,600 cu. ft. per second, or 37 cu. ft. per second per square mile of tributary drainage area. This flood was almost equaled by that of Oct. 11, 1903, when the flow is given as 250,000 cu. ft. per second in round numbers. This flood was due to a very heavy rainfall which at the same time caused a record breaking flood on the Passaic River in Northern New Jersey.

On the Schulykill River on March 1, 1902, a flow of 42.9 cu. ft. per second per square mile of drainage area took place over Fairmount Dam, Philadelphia.

The Susquehanna River is especially subject to floods. That of June 2, 1889, was the highest on record. We quote the Commission's remarks respecting this flood as follows:

The flood of June, 1889, when a large part of the city of Harrisburg was under water, had, at that point, a maximum rate of discharge of from 28 to 30.6 second-feet per square mile of drainage area. The storm causing this flood was general over a large portion of the state and lasted about 34 hours, during which time from 4 to 9 ins. of rain fell on the drainage basin. This flood reached a stage of 33.5 ft. above low water at Williamsport on the West Branch, while the highest stage at that point during the flood of 1865 was 27 ft. The Chemung River, a tributary of the North Branch of the Susquehanna, with a drainage area of 2,055 square miles, reached a maximum rate of flow at Elmira on June 1, of 67 second-feet per square mile.

On the West Branch of the Susquehanna River the flood damage has been particularly destructive in the city of Williamsport. In the flood of 1889, there were 78 lives lost there and enormous damage was wrought. The North Branch of the Susquehanna has in recent years caused disastrous floods in Wilkesbarre. In March, 1902, and March, 1904, the floods here destroyed bridges costing $1,300,000 and millions of dollars worth of other property.

On the Ohio River at Pittsburg there have been six great floods in the last 24 years, and four of these have taken place since 1902.

In 1895 a law was passed in Pennsylvania under which the state assumes the burden of rebuilding county bridges destroyed by floods. Since 1897 demands on the state treasury for this purpose have amounted to $4,417,000. Of this amount about $3,500,000 was expended in the three years, 1902, 1904 and 1907.

The Commission's recommendations respecting flood control are as follows:

This Commission recommends the placing of the flood control work under the direction of a central state authority, to prepare a comprehensive scheme of cooperation and concerted action by municipalities and public and private corporations. Protective measures such as dikes, walls, local straightening of channels, etc., sometimes effective, fail in that they do not reach the source of the trouble. The state should lead the way toward correcting as far as possible the causes of the floods.

Certain flood conditions may be ameliorated by the reforestation of the denuded forest areas of the state, by the construction of extensive storage reservoirs upon tributaries of rivers, and by straightening, widening and deepening stream channels. By such means it may be possible to prevent the increasing frequency and damage of floods, but such works must necessarily be extensive. Dams impounding large quantities of water would have to be erected; the flow from them to be so controlled that at periods when floods might be expected, the reservoirs would be at least partially emptied and ready to receive the flood water. The first work of this nature in the state is soon to be commenced at Harrisburg, where considerable damage has resulted from the floods in Paxton Creek, a stream which passes through the city, draining an area of 23 square miles. Plans are being prepared by the city for the construction of a storage reservoir, to be located about five miles above the creek mouth, to catch and hold the flood flow, with gates so operated as to allow the passage of a more uniform quantity of water throughout the year.

A MACHINE FOR BORING ROCK TUNNELS.

The three illustrations herewith show a machine which its builders expect to accomplish very radical changes in the tunneling through rock. The machine is designed to chip away the heading face by the action of a number of pneumatic hammers fitted with chisel or point bits (as may be suited to the kind of rock encountered), a sufficient number of hammers being used that, when the holder or head on which they are mounted is rotated in the axis of the tunnel, every part of the circular face is reached by the bits. Means for supporting and turning this head, feeding it forward, adjusting its position laterally and vertically, and means for bringing away the rock chips from the face, form the other essential parts of the machine. It is the joint invention of Mr. E. F. Terry, of the New York contracting firm of Terry & Tench Co., and Mr. O. S. Proctor, of Denver. A new corporation, the Terry, Tench & Proctor Tunneling Machine Co., has been formed to build and perfect the machine and put it to use in contract work. The first machine is well along toward completion.

The general view Fig. 1, reproduced from a drawing of the completed machine in substantially the form now being built, will enable its principle of working to be understood. The machine is carried on a four-wheel main truck at the rear and a two-wheel guide truck at the front. The rear truck runs on a 22-in.-gage track of light T-rails laid on wooden ties along the center line of the finished tunnel excavation. Midway between these rails is laid a line of duplex rack-rail, which is engaged by a double (staggered) spur gear journaled on the truck and operated by an engine on the truck, whereby the whole machine is fed forward to its work. The front truck has broad conical wheels adapted to run on the invert part of the tunnel bed. (See cross-section in Fig. 2.) On the front truck rests the forward end of a 20-in. I-beam laid flatwise, which is the frame of the machine. The rear end of this I-beam bears a yoke casting which is carried adjustably on the rear truck. A horizontal and a vertical screw, which can be operated by power, permit this yoke to be moved vertically or laterally, whereby either the alinement of the frame or its gradient can be varied. In the frame beam are seated two bearings, one over the front truck, the other near the rear, in which a hollow longitudinal shaft is mounted. This shaft carries the drill head at its forward end.

The drill head is the simplest element of the machine. It comprises a hub, a peripheral casing, four connecting arms, and four bars to which the hammers are fastened. These bars are straight in radial direction, and the hammers are seated in a plane parallel to the axis, as in Fig. 2 (not in the skewed helicoidal grouping of Fig. 1). The profile of the bars seen at right angles to the shaft, however, is slightly convex forward, so that the group of hammers on the bar has different angles, the outer hammers being tilted slightly outward, while the inner ones are tilted inward. Six hammers are mounted on each bar except one, which latter has seven, to cover the central portion of the face. The hammers on successive arms are at slightly different radial distances from the center, so that as the head rotates they cut along different circles. Four of the hammers on each bar are grouped in a close cluster at the outer end, to concentrate cutting power on the longest cutting zone.

Between the four groups of hammers are fixed steel plates which, with the casing of the head, form pockets adapted to catch the rock chips split off the face wall by the hammers. These pockets, when they reach the upper quarter of the rotation, discharge into a hopper behind the head, which in turn discharges to a belt conveyor leading to the rear end of the machine.

The hollow shaft leads air to the drills through its central bore, hose connections being taken off valved branches fitted in the front end of the shaft. An air-chamber at the rear of the shaft with stuffingbox in which the shaft rotates is bolted to the frame beam, and receives air from the supply pipe. Thrust collars on the rear bearing transmit the feed thrust from the frame to the head.

Rotation of the head is accomplished by a compressed-air engine mounted on the forward part of the frame (see Fig. 2), which, by worm-wheel drive rotates a longitudinal shaft carrying a pinion on its front end. This pinion meshes with a gear bolted to the rear face of the hub of the drill head. The feed is also operated by an air engine, this one being set on the rear truck, and driving, by a friction wheel, a gear train which turns the feed gear meshing with the rack bolted to the ties as already mentioned. This engine also drives the belt conveyor, by a sprocket chain from the engine shaft to the shaft of the rear conveyor pulley.

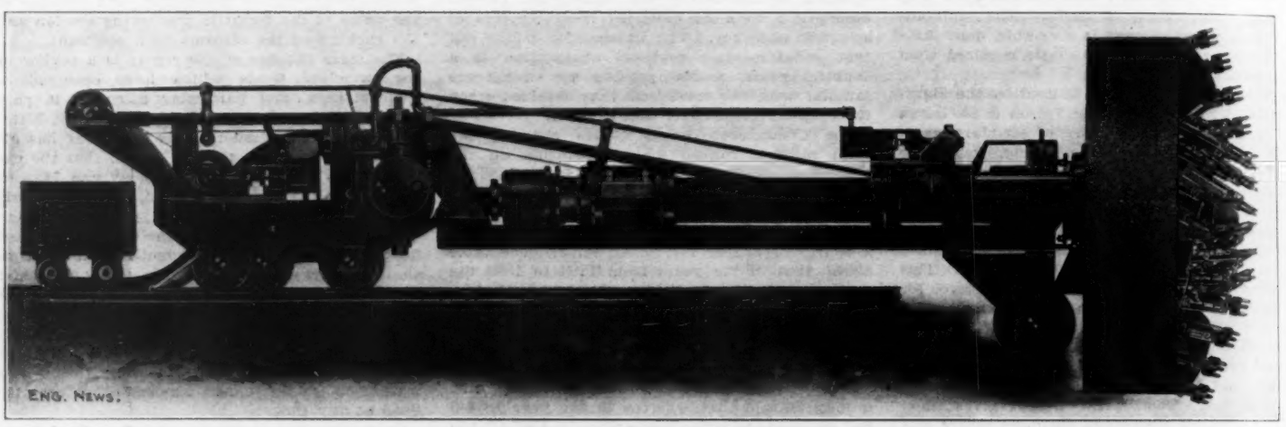


FIG. 1. TERRY, TENCH & PROCTOR CO.'S ROCK TUNNEL DRILLING MACHINE IN POSITION ON WORKING TRACK.
(From a drawing. The tool-head as shown is not the preferred form; the tools are now set in planes parallel to the shaft.)

The conveyor is to the left of the center line, and extends from below the hopper which receives the chips from the head pockets, to a point above and behind the rear truck, where it drops the debris into mucking cars brought up behind the machine. It is planned to lay four rails behind the machine, the central two being the track rails of the rear truck, while the outer two with the middle two form two 18-in.-gage tracks for small mucking cars. A transfer apron is to be attached to the rear of the machine, on which the cars are shifted from the incoming track to a point under the conveyor discharge and thence, when full, to the outgoing track.

The hammers which do the actual work of breaking the rock are, of course, the vital part of the machine. The design shown in Fig. 3, with a 3-in. cylinder, has been worked out for them. The valve is operated by air through small ports communicating with the cylinder. Spring cushions are provided at front and rear end of cylinder. The front cushion has cup leather packings at both ends of the spring; compressed air is admitted between the packings by a small connection with the air supply, which will give an air-cushion action added to

the spring action. Clamps of U-shape, as shown in Fig. 3, hold the hammers to the radial bars of the drill head.

When the machine is in final working shape it will probably have some auxiliary devices for facilitating operation. One of these already planned is an indicating arrangement which will tell the operator at all times whether the feed is just keeping up with the advance of the chisels or is too fast or too slow. In this arrangement each hammer is equipped with a pair of contacts, the rear one closing when the chisel does not cut as fast as the feed, and the front one closing when the chisel cuts faster than the feed. These contacts will light up one or the other of a pair of colored electric lamps mounted back of the respective hammer on the drill head. Thus the operator will know from the color of the lamps lighted whether he is feeding at the proper rate to keep up with the cut. The lamps will also inform him when a chisel strikes a pocket and therefore runs too far forward in its stroke, and if necessary he can then cut off the air supply from the hammer in question, by means of a series of electric buttons controlling the air supply valves. Provision will also be made for a water spray at the face to keep down dust, with control valve at the operator's position.

The machine now being built is designed with an 8-ft. drill head, which is the size shown in our illustrations. It is understood that the builders believe this to be the most favorable size, irrespective of the size of tunnel to be built, and that for say a railway tunnel they would recommend driving an 8-ft. heading with the machine and breaking down to full section by the regular drilling and blasting procedure.

STRESSES IN THE BLACKWELL'S ISLAND (QUEENSBORO) BRIDGE UNDER FULL SPECIFIED LOADING.

We discussed in our last issue the serious overstresses in the Blackwell's Island Bridge, as shown in the expert reports upon the structure. It now develops that the condition of overload is even worse than was shown in the text of these reports.

During the past week the Commissioner of Bridges of New York City requested Messrs. Boller & Hodge to furnish the stress sheet which they calculated for the specified "congested loading." This sheet was not available when our last issue was published. Since then we have inspected this sheet and taken from it the complete list of stresses in the worst stressed region, viz., the Island Span and the Island Cantilever Arm West. These stresses are reprinted in the table on the two following pages.

We quoted from Prof. Burr's report last week the statement that in the Queens anchor arm there would be 30% overstress in carbon steel eyebars and "in the riveted tension members in the same parts of the bridge, overstresses rising above 33% in a single instance."

The accompanying table from Boller & Hodge's stress sheet shows that instead of one riveted tension member being overstressed 33%, there are actually several members overstressed 45 to 47%. It will be understood that these percentages of overstress are in both cases based on the very high unit working stresses which were permitted by the specifications for this "congested loading."

In comparing the table with that printed last week, it will be seen that both refer to the same parts of the bridge. The one last week showed the stresses under the loading which is considered safe by Boller & Hodge, and the stresses should be compared with the unit stresses specified for working load, which they accept as the *limit of safety*. The table on the following pages, however, is for the "congested" loading of the specifications, for which the following high unit-stresses were permitted by the specifications, viz., 39,000 lbs. per sq. in. tension on nickel-steel eyebars, as against 30,000 under the "working" load; 24,000 tension on riveted or eyebar carbon-steel members as against 20,000, etc. The only point in which no distinction is made between "working" and "congested" loads is in the stresses of floor-system, hangers and subdiagonals, the last two of which appear in our tables. The stresses in these members differ from those given last week

(Continued on page 560.)

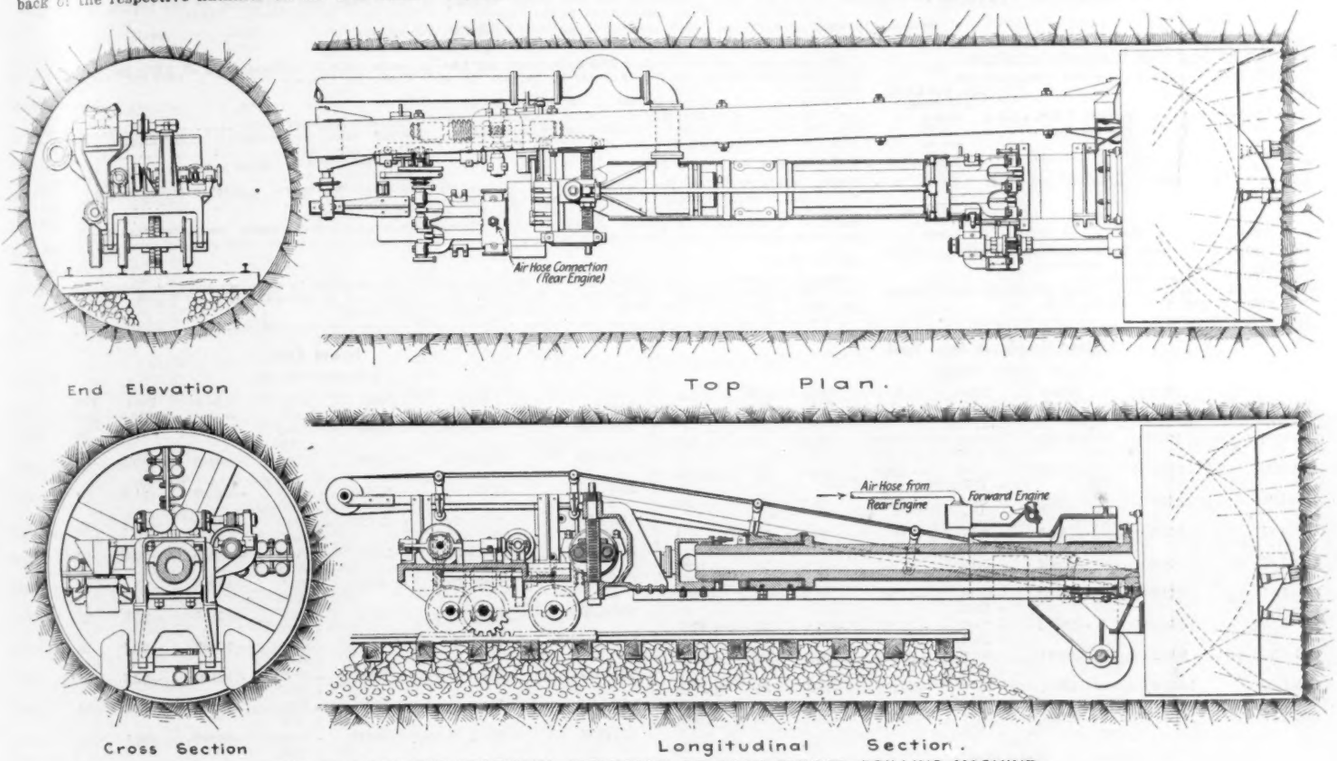


FIG. 2. PLAN AND SECTIONAL ELEVATION OF ROCK TUNNEL DRILLING MACHINE.

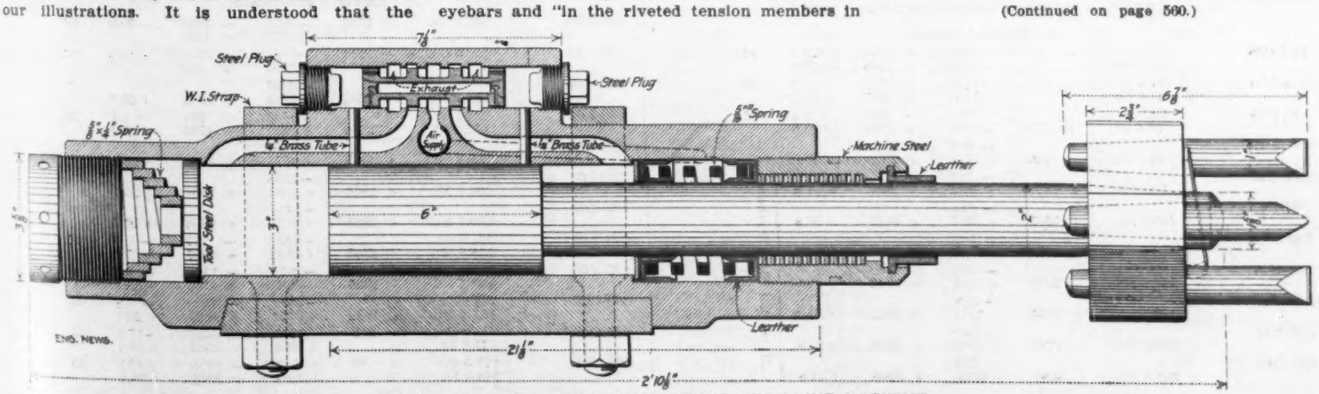
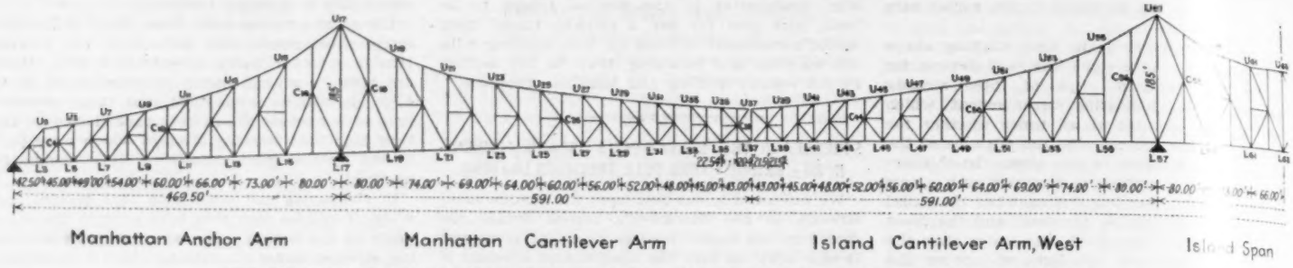


FIG. 3. AIR TOOL FOR ROCK TUNNEL DRILLING MACHINE.



THE BLACKWELL'S ISLAND (QUEENSBORO) BRIDGE. STRESSES UNDER SPECIFIED CONGESTED LOADING.

From stress sheet prepared by Boller & Hodge in connection with their expert report on the safe traffic capacity of the bridge, and submitted at the request of the Department of Bridges subsequent to the report.

Stresses in units of 1,000 lbs. Unit-stresses in units of 1,000 lbs. per sq. in.
+ indicates tension. — indicates compression.

COMPUTED FOR THE FOLLOWING LOADS.

LIVE LOAD: *Main Members* computed for

	Lbs. per lin ft. per truss.
Two lines of elevated railway, 1,700.....	3,400
11-ft. footwalk, 75 lbs. per sq. ft.....	825
Upper floor	4,225
Two lines of street cars, 1,000.....	2,000
17½-ft. width of roadway, 100 lbs. per sq. ft	1,775
	3,775
Total live load, per foot of truss....	8,000

This load is to be placed in the positions giving maximum stresses in the individual members.

Sub-Members computed for

On each elevated railway track 104,000-lb. cars having four axles spaced 6 ft., 10 ft., 6 ft.

On each street railway track a 52,000-lb. street car having two axles spaced 10 ft., or 1,800 ft. per lin. ft. of track.

On any part of roadway 48,000 lbs. on two axles 10 ft. apart and 5 ft. gage covering a space 12 ft. x 30 ft., and 100 lbs. per sq. ft. on the remaining roadway surface.

On the footwalk a load of 100 lbs. per sq. ft.

WIND LOAD.

Wind pressure, 2,000 lbs. per lin. ft. of bridge, all acting in plane of bottom chord. Of this 1,000 lbs. is taken as covering the entire bridge, and 1,000 lbs. is taken as a moving load placed in the positions giving maximum stresses in the individual members.

DEAD LOAD.

Stresses computed for the weight of metal in the structure, 105,122,031 lbs. for the bridge or 52,561,016 lbs. per truss, distributed according to the actual panel-loads, plus a uniform load of 3,650 lbs. per lin. ft. of truss, as follows:

	Lbs. per lin. ft. of truss.
Concrete sub-pavement	1,600
Wood block pavement	520
Street car tracks	187
Elevated railway tracks	485
Footwalk slab	250
Sidewalk stringers, cantilever brackets and gratings	202
Three railings	203
Gas mains, mail chutes, trolley wires, telephone cables and their attachments, etc.	203
	3,650

The stresses in only two arms are reproduced here, but these are in general the most heavily stressed parts of the bridge.

Island Cantilever Arm, West.

BOTTOM CHORD.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
L37-L39	75.0 Gr.	— 15	.....	— 15	— 0.2	18	± 54
L39-L41	105.0 Gr.	— 680	—1621	— 2301	—21.9	19	± 187
			+ 1347	+ 667			
L41-L43	210.0 Gr.	— 1620	—2446	— 4066	—19.4	21	± 363
			+ 1570				
L43-L45	247.6 Gr.	— 2929	—3321	— 6250	—25.2	22	± 593
			+ 1609				
L45-L47	355.6 Gr.	— 4625	—4327	— 8952	—25.2	24	± 888
			+ 1545				
L47-L49	510.8 Gr.	— 6604	—5404	—12008	—23.5	26	±1269
			+ 1409				
L49-L51	666.8 Gr.	— 8722	—6478	—15200	—22.8	27	±1903
			+ 1243				
L51-L53	834.8 Gr.	—10876	—7509	—18385	—22.0	30	±2727
			+ 1094				
L53-L55	949.2 Gr.	—12271	—8011	—20282	—21.4	32	±3776
			+ 935				
L55-L56	1040.2 Gr.	—12001	—7858	—20459	—19.7	34	±4741
			+ 773				
L56-L57	1072.1 Gr.	—12001	—7858	—20459	—19.1	34	±5861
			+ 773				

TOP CHORD.

U37-U39	43.0 Gr.		— 880	— 855	—19.9	29	
	34.4 Nt.	+ 35	+ 785	+ 820	+ 23.8		
U39-U41	43.0 Gr.		— 785	— 598	—13.9	30	
	34.4 Nt.	+ 187	+ 793	+ 980	+ 28.5		
U41-U43	106.0 Gr.		—1271	— 489	— 4.6	40	
	88.0 Nt.	+ 782	+ 1621	+ 2403	+ 27.3		
U43-U45			—1492				Nickel Steel Eyebars.
	94.5 Nt.	+ 1739	+ 2447	+ 4186	+ 44.3		
U45-U47			—1538				
	141.8 Nt.	+ 3079	+ 3346	+ 6425	+ 45.3		
U47-U49			—1473				
	210.0 Nt.	+ 4819	+ 4375	+ 9194	+ 43.8		
U49-U51			—1343				
	290.0 Nt.	+ 6878	+ 5498	+ 12376	+ 42.7		
U51-U53			—1186				
	384.0 Nt.	+ 9128	+ 6651	+ 15779	+ 41.1		
U53-U55			—1112				
	496.0 Nt.	+11822	+ 8065	+ 19887	+ 40.1		
U55-U57			—1065				
	612.0 Nt.	+14516	+ 9409	+ 23925	+ 39.1		

MAIN DIAGONALS.

U37-C38	57.2 Gr.	— 50	—1109	— 1159	—20.3	44	
	45.7 Nt.		+ 1358	+ 1308	+ 28.6		
C38-L39	74.6 Gr.	— 242	—1119	— 1361	—18.2	46	
	61.0 Nt.		+ 1109	+ 867	+ 14.2		
L39-C40	92.5 Gr.		— 995	— 221	— 2.4	56	
	77.4 Nt.	+ 774	+ 1412	+ 2186	+ 28.0		
C40-U41			— 805				
	84.3 Nt.	+ 926	+ 1428	+ 2354	+ 27.9		
L41-C42			— 724				Structural Steel Eyebars.
	105.0 Nt.	+ 1338	+ 1562	+ 2900	+ 27.6		
C42-U43			— 644				
	115.5 Nt.	+ 1505	+ 1597	+ 3102	+ 26.9		
L43-C44			— 509				
	136.5 Nt.	+ 1926	+ 1730	+ 3656	+ 26.8		
C44-U45			— 462				
	152.2 Nt.	+ 2128	+ 1815	+ 3943	+ 25.9		
L45-C46			— 368				
	173.3 Nt.	+ 2535	+ 1977	+ 4532	+ 26.2		
C46-U47			— 334				
	189.0 Nt.	+ 2785	+ 2085	+ 4870	+ 25.8		
L47-C48			— 230				
	210.0 Nt.	+ 3087	+ 2121	+ 5208	+ 24.8		

Island Span.

BOTTOM CHORD.

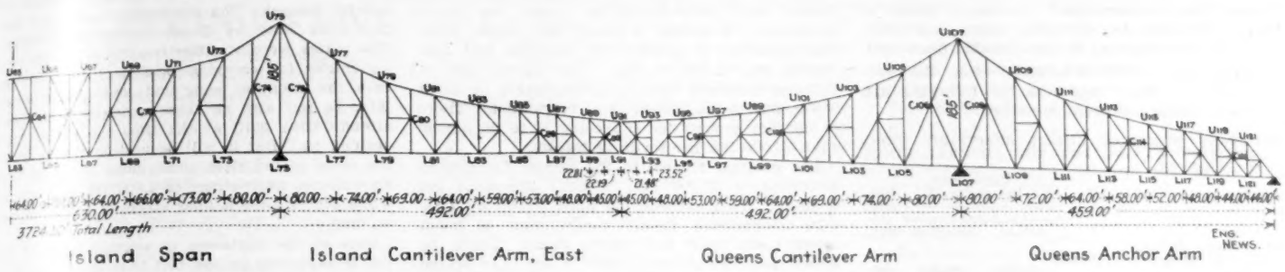
Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
L57-L58	1066.9 Gr.	—12566	—7902	—20468	—19.2	34	±5861
			+ 820				
L58-L59	1049.9 Gr.	—12566	—7902	—20468	—19.5	34	±5262
			+ 820				
L59-L61	1032.8 Gr.	—13271	—9255	—22526	—21.8	31	±4969
			+ 1206				
L61-L63	925.5 Gr.	—12090	—10238	—22328	—24.1	28	±4551
			+ 2381				
L63-L65	770.0 Gr.	—10063	—9922	—19985	—26.0	27	±4289
			+ 2916				
L65-L67	686.7 Gr.	— 8805	—9615	—18420	—26.8	27	±4100
			+ 3225				
L67-L69	651.3 Gr.	— 8136	—9002	—17138	—26.3	27	±3979
			+ 3011				
L69-L71	685.5 Gr.	— 8710	—8685	—17395	—25.4	28	±3926
			+ 2539				
L71-L73	717.0 Gr.	— 8813	—7287	—16100	—22.5	31	±3947
			+ 1407				
L73-L74	711.2 Gr.	— 8041	—5855	—13896	—19.5	34	±4028
			+ 894				
L74-L75	711.2 Gr.	— 8041	—5855	—13896	—19.5	34	±4258
			+ 894				

TOP CHORD.

U57-U59			—1329				Nickel Steel Eyebars.
	660.0 Nt.	+15866	+10913	+ 26779	+ 40.6		
U59-U61			—2368				
	516.0 Nt.	+12593	+10511	+ 23104	+ 44.8		
U61-U63			—2916				
	426.0 Nt.	+10218	+ 9922	+ 20140	+ 47.3		
U63-U65			—3225				
	384.0 Nt.	+ 8950	+ 9615	+ 18565	+ 48.4		
U65-U69			—3256				
	360.0 Nt.	+ 8318	+ 9309	+ 17627	+ 49.0		
U69-U71			—3011				
	360.0 Nt.	+ 8276	+ 9002	+ 17278	+ 48.0		
U71-U73			—2531				
	392.0 Nt.	+ 9094	+ 8916	+ 18010	+ 45.9		
U73-U75			—1506				
	448.0 Nt.	+10583	+ 8592	+ 19175	+ 42.8		

MAIN DIAGONALS.

U57-C58	365.0 Gr.	— 1736	—5684	— 7420	—20.3	94	
			+ 3227	+ 1491			
C58-L59	400.0 Gr.	— 2234	—5684	— 7918	—19.8	94	
			+ 3053	+ 819			
L59-C60			—2397				
	225.3 Nt.	+ 2503	+ 2813	+ 5316	+ 23.6		
C60-L61	238.7 Gr.		—2405	— 291	— 1.2	38	
	199.5 Nt.	+ 2114	+ 2655	+ 4769	+ 23.9		
L61-C62			—2276				
	330.7 Nt.	+ 4195	+ 4173	+ 8368	+ 25.3		
C62-L63			—2358				
	304.5 Nt.	+ 3833	+ 4103	+ 7936	+ 26.1		
L63-C64			—2457				
	239.7 Nt.	+ 2665	+ 3729	+ 6394	+ 26.7		
C64-L65	261.9 Gr.		—2456	— 111	— 0.4	45	
	218.6 Nt.	+ 2345	+ 3692	+ 6037	+ 27.6		
U65-C66	196.9 Gr.		—2071	— 1346	— 6.8	40	
	163.7 Nt.	+ 1325	+ 3380	+ 4705	+ 28.7		
C66-L67	181.9 Gr.		—2811	— 1789	— 9.8	40	
	151.2 Nt.	+ 1022	+ 3374	+ 4396	+ 29.1		
L67-C68	211.9 Gr.	— 382	—3241	— 3623	—17.1	45	
	171.6 Nt.		+ 2969	+ 2587	+ 15.1		
C68-U69	177.5 Gr.	— 89	—3124	— 3213	—18.1	40	
	148.0 Nt.		+ 2998	+ 2909	+ 19.7		



Island Cantilever Arm, West (continued).

MAIN DIAGONALS. (Continued.)

Member.		Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
C48-U49		224.0 Nt.	+ 3348	— 210 +2250	+ 5598	+25.0		
L49-C50		228.0 Nt.	+ 3464	— 114 +2143	+ 5607	+24.6		
C50-U51		248.0 Nt.	+ 3761	— 105 +2290	+ 6051	+24.4		
L51-C52		240.0 Nt.	+ 3711	— 27 +2069	+ 5780	+24.1		
C52-U53		280.0 Nt.	+ 4049	— 25 +2231	+ 6280	+22.4		
L53-C54		182.0 Nt.	+ 2556	— 630 +1837	+ 4393	+24.1		
C54-U55		204.0 Nt.	+ 2926	— 630 +2006	+ 4932	+24.2		
L55-C56		106.1 Gr.		—1861	— 1476	—13.9	93	
C56-U57		89.9 Nt. 129.7 Gr. 108.2 Nt.	+ 385 + 803	+1678 —1861 +1852	+ 2063 — 1058 + 2655	+22.9 — 8.2 +24.5	93	

Structural Steel Eyebars.

MAIN POSTS.

Member.		Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
U39-L39	T	44.1 Gr.	— 191	— 127	— 318	— 7.2	38	
	B	72.9 Gr.	— 257	— 220	— 477	— 6.5		
U41-L41	T	74.7 Gr.	— 674	— 988 + 620	— 1662	—22.3	41	
	B	102.7 Gr.	— 745	—1057 + 591	— 1802	—17.5		
U43-L43	T	103.0 Gr.	— 1098	—1115 + 450	— 2213	—21.5	42	
	B	139.8 Gr.	— 1183	—1199 + 428	— 2382	—17.0		
U45-L45	T	130.4 Gr.	— 1547	—1271 + 322	— 2818	—21.6	46	
	B	166.2 Gr.	— 1641	—1369 + 306	— 3010	—18.1		
U47-L47	T	156.2 Gr.	— 1937	—1379 + 204	— 3316	—21.2	48	
	B	191.5 Gr.	— 2045	—1492 + 194	— 3537	—18.5		
U49-L49	T	178.6 Gr.	— 2273	—1406 + 101	— 3679	—20.6	54	
	B	213.5 Gr.	— 2351	—1533 + 97	— 3884	—18.2		
U51-L51	T	186.4 Gr.	— 2472	—1356 + 24	— 3828	—20.5	51	
	B	221.7 Gr.	— 2557	—1496 + 23	— 4053	—18.3		
U53-L53	T	136.2 Gr.	— 1495	—1193 + 555	— 2688	—19.7	59	
	B	172.2 Gr.	— 1586	—1344 + 555	— 2930	—17.0		
U55-L55	T	88.5 Gr.	+ 489	—1084	— 595	— 6.7	63	
	B	76.5 Nt. 126.0 Gr.	+ 542 + 392	+1708 —1247	+ 2250 — 855	+29.4 — 6.8		
			+ 489	+1708	+ 2197			

ROCKER ARM AND HANGERS.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
U37-L37	44.1 Gr.		—1003	— 993	—22.5	64	
	31.2 Nt.	+ 10	+ 884	+ 894	+28.6		
C38-L38	31.0 Nt.	+ 179	+ 379	+ 558	+18.0		
C40-L40			— 28				
C42-L42	31.0 Nt.	+ 187	+ 313	+ 500	+16.1		
			— 40				
C44-L44	31.0 Nt.	+ 195	+ 330	+ 525	+16.9		
C46-L46	31.0 Nt.	+ 243	+ 320	+ 563	+18.2		
C48-L48	44.0 Nt.	+ 272	+ 338	+ 610	+13.9		
C50-L50	44.0 Nt.	+ 307	+ 355	+ 662	+15.0		
C52-L52	44.0 Nt.	+ 347	+ 371	+ 718	+16.3		
C54-L54	44.0 Nt.	+ 393	+ 391	+ 784	+17.8		
C56-L56	52.0 Nt.	+ 437	+ 411	+ 848	+16.3		
	52.0 Nt.	+ 488	+ 434	+ 922	+17.7		

SUB DIAGONALS.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
C38-L37	21.5 Nt.	+ 24	.....	+ 24	+ 1.1		
C38-U39	36.0 Nt.	+ 241	+ 268	+ 509	+14.1		
C40-L41	23.0 Gr.	— 148	— 203 + 19	— 351	—15.3	39	
C42-L43	25.7 Gr.	— 166	— 212 + 26	— 378	—14.7	43	
C44-L45	28.4 Gr.	— 202	— 205	— 407	—14.3	48	
C46-L47	31.1 Gr.	— 231	— 214	— 445	—14.3	41	
C48-L49	33.8 Gr.	— 262	— 221	— 483	—14.3	45	
C50-L51	36.4 Gr.	— 297	— 225	— 522	—14.3	50	
C52-L53	42.1 Gr.	— 338	— 231	— 569	—13.5	48	
C54-L55	49.4 Gr.	— 370	— 233	— 603	—12.2	58	
C56-L57	75.0 Gr.	— 419	— 237	— 656	— 8.7	90	

SUB POSTS.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
U38-C38	15.0 Gr.	— 17	.....	— 17	— 1.1		
U40-C40	15.0 Gr.	— 19	.....	— 19	— 1.3		
U42-C42	15.0 Gr.	— 32	.....	— 32	— 2.1		
U44-C44	15.0 Gr.	— 31	.....	— 31	— 2.1		
U46-C46	15.0 Gr.	— 39	.....	— 39	— 2.6		
U48-C48	15.0 Gr.	— 44	.....	— 44	— 2.9		
U50-C50	15.0 Gr.	— 59	.....	— 59	— 3.9		
U52-C52	15.0 Gr.	— 76	.....	— 76	— 5.1		
U54-C54	15.0 Gr.	— 104	.....	— 104	— 6.9	57	
U56-C56	21.8 Gr.	— 137	.....	— 137	— 6.3	61	

Island Span (continued).

MAIN DIAGONALS. (Continued.)

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
L69-C70	196.9 Gr.		—3044	— 2157	—11.0	35	
	164.2 Nt.	+ 887	+ 3360	+ 4247	+25.9		
C70-U71	217.6 Gr		—2957	— 1761	— 8.1	35	
	181.3 Nt.	+ 1196	+ 3425	+ 4621	+25.5		
L71-C72	211.0 Gr.	— 98	—3243	— 3341	—15.8	38	
	176.4 Nt.		+ 2529	+ 2431	+13.8		
C72-U73	187.5 Gr.		—3232	— 2984	—15.9	38	
	157.0 Nt.	+ 248	+ 2684	+ 2932	+18.7		
L73-C74	388.7 Gr.	— 2350	—5577	— 7927	—20.4	94	
			+ 3064	+ 714			
C74-U75	353.0 Gr.	— 1922	—5577	— 7499	—21.2	94	
			+ 3238	+ 1316			

MAIN POSTS.

Member.		Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
U57-L57	T	1250.6 Gr.	—15937	—9222 + 2077	—25159	—20.1	53	
	B	1250.6 Gr.	—16497	—9222 + 2077	—25719	—20.6	53	
U59-L59	T	236.9 Nt.	+ 3120	—2349 + 5217	+ 8337	+35.2		
	B			—2511 + 5217	+ 8210			
U61-L61	T	163.3 Gr.	— 1060	—1937	— 2997	—18.4	54	
	B	227.3 Gr.	— 991 — 1147	+ 2127 —2078	+ 1136 — 3225	—14.2		
U63-L63	T	281.0 Gr.	— 1060 — 2594	+ 2121 —3277	+ 1061 — 5871	—20.9	62	
	B	343.0 Gr.	— 2675	+ 2142 —3370	— 6045	—17.6		
U65-L65	T	191.0 Gr.	— 1368	+ 2098 —2971	— 4339	—22.7	57	
	B	254.5 Gr.	— 1294 — 1448	+ 2347 —3048	+ 1053 — 4496	—17.7		
U67-L67	T	100.8 Gr.	— 1368 — 144	+ 2289	+ 921 — 144	— 1.4	54	
	B	165.8 Gr.	— 224	— 191	— 415	— 2.5		
U69-L69	T	141.8 Gr.	— 107	—2635	— 2742	—19.3	54	
	B	121.7 Nt. 206.3 Gr.	— 42 — 188	+ 2746 —2725	+ 2704 — 2913	+22.2 —14.1		
U71-L71	T	174.2 Gr.	— 107 + 804	+ 2699 —1827	+ 2592 — 1023	— 5.9	57	
	B	148.7 Nt. 237.7 Gr.	+ 877 + 717	+ 2866 —1967	+ 3743 — 1250	+25.2 — 5.3		
U73-L73	T	236.9 Nt.	+ 804 + 3143	+ 2859 —2360 + 5118	+ 3663 + 8261	+34.9		
	B			—2522				
U75-L75	T	919.3 Gr.	+ 3016 —10686	+ 5118 —7886	+ 8134 —18572	—20.2	53	
	B	919.3 Gr.	—11125	+ 2741 —7886 + 2741	—19011	—20.7	53	

HANGERS.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
C58-L58	51.0 Nt.	+ 533	+ 434	+ 967	+19.0		
C60-L60	51.0 Nt.	+ 437	+ 406	+ 843	+16.5		
C62-L62	43.0 Nt.	+ 382	+ 380	+ 762	+17.7		
C64-L64	43.0 Nt.	+ 356	+ 371	+ 727	+16.9		
C66-L66	43.0 Nt.	+ 346	+ 371	+ 717	+16.7		
C68-L68	43.0 Nt.	+ 342	+ 371	+ 713	+16.6		
C70-L70	43.0 Nt.	+ 356	+ 380	+ 736	+17.1		
C72-L72	51.0 Nt.	+ 398	+ 406	+ 804	+15.8		
C74-L74	51.0 Nt.	+ 451	+ 434	+ 885	+17.4		

SUB DIAGONALS.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
C58-L57	75.0 Gr.	— 499	— 237	— 736	— 9.8	90	
C60-L59	53.0 Gr.	— 389	— 231	— 620	—11.7	30	
C62-L61	45.7 Gr.	— 362	— 218	— 580	—12.7	31	
C64-L63	42.1 Gr.	— 320	— 211	— 531	—12.6	31	
C66-L65	53.0 Gr.	— 303	— 211	— 514	— 9.7	37	
C68-L69	42.1 Gr.	— 293	— 211	— 504	—12.0	31	
C70-L71	45.7 Gr.	— 309	— 218	— 527	—11.5	31	
C72-L73	53.0 Gr.	— 345	— 231	— 576	—10.9	30	
C74-L75	75.0 Gr.	— 428	— 237	— 665	— 8.9	90	

SUB POSTS.

Member.	Area sq. ins.	Dead Load.	Live Load.	D. L. + L. L.	Unit Str.	L/R Abt.	Wind Str.
U58-C58	21.8 Gr.	— 151	.....	— 151	— 6.9	60	
U60-C60	15.0 Gr.	— 107	.....	— 107	— 7.1	62	
U62-C62	15.0 Gr.	— 84	.....	— 84	— 5.6		
U64-C64	15.0 Gr.	— 75	.....	— 75	— 5.0		
U66-C66	15.0 Gr.	— 71	.....	— 71	— 4.7		
U68-C68	15.0 Gr.	— 71	.....	— 71	— 4.7		
U70-C70	15.0 Gr.	— 73	.....	— 73	— 4.9		
U72-C72	15.0 Gr.	— 88	.....	— 88	— 5.9	62	
U74-C74	21.8 Gr.	— 107	.....	— 107	— 4.9	60	

(Continued from page 557.)

because the "recommended" loading of Boller & Hodge included no elevated trains and contemplated the removal of considerable dead-load.

GREATEST UNIT-STRESSES—For the several kinds of main members the following are the most heavily stressed members:

GREATEST STRESSES UNDER SPECIFIED "CONGESTED" LOADING FOR THE SEVERAL KINDS OF MEMBER.

	Unit-stress, lbs. per sq. in.		Per cent.
	Dead and live—		
	Actual.	Specified	ess.
Nickel-Steel Eyebars:			
U65—U69 (Top Chord, Island Span)	+49,000	+39,000	26
Structural-Steel Eyebars:			
C116—L117 (Main Diagonal, Queens Anchor Arm)	+31,300	+24,000	30
Riveted Tension Member: (Structural Steel.)			
U59—L59 (Main Post, Island Span)	+35,200	+24,000	47
Riveted Compression Member: (Structural Steel)			
Bottom Chord.			
L65—L67 (Middle Panel, Island Span)	—26,800	—21,300*	26
Web Member.			
U117—L117 (Main Post, Queens Anchor Arm)	—25,800	—19,500†	32
Compression Member with Greatest Stress.	*Percent Over-*		
C74—U75 (Main Diagonal, Island Span)	—21,200	—14,600‡	45
Member Carrying Reversed Stress:			
L91—C92 (Main Diagonal, Queens Cantilever Arm).	—23,300	—19,500§	20
	+33,300	+24,000	39

*For l/r = 27
†For l/r = 45
‡For l/r = 94
§For l/r = 45
} by formula 24,000 — 100 l/r.

The serious significance of these over-stresses, however, appears from comparison with the elastic limits of the material, rather than with the specified stresses. The actual stresses quoted include no allowance for wind stresses (though these would materially increase the stresses in the bottom chords), and no allowance for secondary bending stresses (though these amount in some members to several thousand pounds per square inch). For these reasons the stresses even under congested load should remain so far below the elastic limits of the respective members as to give room for these additional minor stresses, as well as to provide against the inevitable non-uniformities of stress distribution, of which the calculation takes no account. Yet so far from allowing this indispensable margin, the stresses under dead and live loads alone *exceed the elastic limit*, in some cases very considerably. The following facts demonstrate this:

NICKEL-STEEL EYEBARS.—A hundred or more full-size tests of bars were made, and the elastic limits were carefully measured in all of them by extensometer. Many tests showed elastic limits higher than 49,000 lbs. per sq. in., but almost as many showed elastic limits below this point. The specified figure was 48,000 lbs. per sq. in. Those bars which fell below 48,000 lbs. were rejected, but as only one bar was tested out of forty or fifty furnished, it cannot be claimed that all the bars used in the bridge are stronger than 48,000 lbs. elastic limit. In fact, since the tests showed a few elastic limits as low as 40,000 lbs. per sq. in., there is a good presumption that the weakest nickel-steel bar in the structure does not greatly exceed this strength.

In contrast, the stress calculation shows 49,000 lbs. per sq. in. in some panels of bars, without allowance for bending or non-uniform stress.

CARBON-STEEL EYEBARS.—The specifications required full-size tests to show an elastic limit of 28,000 lbs. per sq. in. The acceptance tests satisfied this figure, without greatly exceeding it. The crippling strength of a panel of these bars, therefore, is limited to 28,000 lbs. per sq. in., provided the total stress divides equally among the several bars, an assumption which cannot be entertained conscientiously. If it divides unequally, the strength of the panel is lower than 28,000.

The actual stress, in the worst case, is 31,300 lbs., which is about 12% over the elastic limit, without allowance for bending or for non-uniformity of stress distribution.

RIVETED MEMBERS.—No full-size tests were made, so that the crippling strength of these members can only be estimated. The specifications say that specimen tests of plates and shapes must show 30,000 lbs. elastic limit as a minimum. Probably a somewhat larger value was obtained, if commercial material was furnished, say 32,000 average. The elastic limit of full-size members would unquestionably be much lower, due to the influences of fabrication. There is no safe ground for supposing it to be higher than 30,000 lbs. per sq. in *in tension*.

The greatest tension in the bridge, for riveted members, is 35,200 lbs., without allowance for bending. This exceeds the limit 30,000 by 17%.

In compression, failure would occur at much lower loads than the tensile elastic limits, in many cases, as previous tests of ordinary bridge struts show. As for tests of the very large compression members in this bridge, 100 to 1,000 sq. ins. cross-section, none have ever been made and it cannot be asserted with confidence that the unit-strength of small columns would be attained. In fact, the Quebec Bridge chords exhibited fatal distress at stresses of 16,000 to 18,000 lbs. per sq. in., and two of them subsequently failed altogether at about 17,000 lbs. per sq. in.

In the Blackwell's Island Bridge the greatest unit-load on a compression member is 26,800 lbs. per sq. in. for a chord member, and 25,800 lbs. per sq. in. for a web member. Having regard to the effect of slenderness, and measuring this effect by the column-formula prescribed in the specifications, the worst case is a diagonal with 21,200 lbs. per sq. in. But as this formula is considered to make an excessive reduction for slenderness, the two former cases may be quoted as the worst compression stresses in the bridge. They include no allowance for bending due to weight, bending due to distortion of truss, or (in the case of the bottom chord) stress due to wind.

EXCESSIVELY LOW STRESSES; WASTED MATERIAL.—Almost as striking as the existence of the dangerous overstresses is the irregularity and apparently erratic character of the stresses, which represents unequal utilization and therefore waste of material. The latter would not be highly important in a bridge of ordinary size, but it becomes critical in a bridge so large that, as in the case of this one, a structure which itself weighs 35,000 lbs. per lin. ft. is able to safely carry only 4,000 lbs. per lin. ft., and where each pound of weight saved adds a pound to the live-load capacity.

The irregularity of stress is exhibited typically by the following summary, prepared from Boller & Hodge's stress sheet for dead-load plus the specified congested live-load:

VARIATIONS OF MAXIMUM STRESS IN DIFFERENT CLASSES OF MAIN MEMBERS.

[Where a member carries both kinds of stress, the lower of the two maxima was not considered in drawing up the following list. Cases of unusually low stress apparently governed by special reasons, as bottom chord adjoining hangers and anchorages, are not included in the list.]

	Tensile or compressive stress, lbs. per sq. in.	
	Lowest.	Highest.
Bottom Chord	—18,900	—26,800
Nickel-Steel Eyebars (in top chord).	+37,400	+49,000
Carbon-Steel Eyebars (in diagonals).	+22,000	+31,300
Riveted Diagonals and Posts	—11,000*	—25,800
	13,600*	+35,200†
Hangers	+13,100	+21,700
Sub-Diagonals	— 8,100	—15,500
		+14,100

*In same member. Other members with but one kind of stress show lowest maximum of —11,100 lbs. per sq. in.
†This is in the posts of Island Span adjoining the towers, only, and may result from an error in design. Other maxima are +33,300 in one of the rockers, and many values between 29,000 and 30,000 in posts.

Between the maximum and minimum cases in each group are found a full range of intermediate values.

The irregularities of stresses in the floor members are even greater. These were stated in Boller & Hodge's report, as follows:

	Variation of Max. Stress, Lbs. per sq. in.
LOWER FLOOR:	
Trolley Stringers with cover-plates	4,600 to 7,000
Trolley Stringers without cover-plates	7,200 to 11,000
Roadway Stringers	7,900 to 14,600
Floorbeams	15,000 to 16,000
UPPER FLOOR:	
Elevated Ry. Stringers	6,500 to 9,100
Sidewalk Stringers	4,100 to 10,900
Floorbeams	13,000 to 14,400
Total variation	4,100 to 16,000

One item in this floor list is explained by special reasons: The cover-plated stringers have the same duty as those without cover-plates. The plates were an afterthought, to fit the trolley-tracks for carrying possible future subway cars, the intention being that cover plates should later be put also on these stringers which had already been built at the time the plates were decided on. But it will be noticed that even in the cover-plated class alone, some stringers have an extreme fiber stress of 4,600 lbs. per sq. in., while others have a fiber stress of 7,000 lbs. per sq. in.

Part of the variation in another item of the list is explained by the fact that the upper floor floorbeams have modified section to carry the erection traveler. The chief items of low stress, however, are for the stringers, and the figures above show that a large amount of unnecessary weight was introduced, for no reason now apparent, and at the cost of valuable live-load capacity.

From the preceding facts regarding irregular and excessively low stresses, it seems probable that a good part of the 25% increase in dead weight during construction (shown by comparing the actual with the estimated weight of the structure) is accounted for by metal wasted by giving some members lower stresses than other members performing similar service.

THE U. S. GOVERNMENT CEMENT MILL at the Roosevelt Dam turned out 52,791 barrels of cement in the six months ending June 30, 1908. The operating cost of manufacturing is reported in detail in the "Reclamation Record" for November from which we quote:

Owing to the fact that the contractors for Roosevelt Dam did not require a larger output the mill was either idle or run at part capacity for a portion of this period. Had the mill been run at full capacity for the period its output would have been about 72,000 barrels and the average cost per barrel would have been somewhat less.

Superintendent and chemists	$0.047
Operating labor	.289
Maintenance labor	.067
Maintenance material	.094
Clay digging	.057
Clay hauling	.063
Quarry expense	.134
Supplies	.038
Fuel—wood	.081
Fuel—oil	.981
Power	.109
Total	$1.96

It will be noted that half the entire cost of the finished cement is the cost of the oil required for burning, which has to be hauled by wagon from Phoenix, 60 miles away.

COMPARATIVE COST OF USING HARD AND SOFT Water in Boiler Plants.—In connection with an investigation of the quality of surface and underground waters in different parts of the United States, R. B. Dole, of the United States Geological Survey, has made an estimate of the saving that may be accomplished in the production cost of steam by the use of a plant for softening hard water.

Analyses of Maumee River water, selected as a typical hard water, show that it contains incrusting solids amounting to 360 parts per million, 105 parts of which are suspended mud, etc., and the rest carbonate and sulphate of calcium with some magnesium, a combination which inevitably forms a hard scale in boilers. If this water were used in a 1,000-HP. boiler, 100,000 gallons daily would be required. In six working days 1,800 pounds of scale would be deposited in the boiler. In the following figures, the first set estimates the probable excess cost due to the use of bad water, while the second estimates the probable cost after purifying the water. The inference to be drawn from the difference in dollars and cents is obvious:

COST WITH USE OF HARD WATER.

Average coal consumption for 1,000 HP. boiler, 48 tons a day, 48 tons of coal at $1.50 is $72. Estimated saving in fuel on this water due to use of treated water is 5 per cent. Five per cent. of $72 is $3.60 per day, or, for 300 working days	$1,080.00
Cleaning boiler, at $8 per week	416.00
Repairs for tubes, etc	200.00
Boiler compounds	250.00
Coal for raising steam after cleaning, 104 tons at $1.50	156.00
7½% depreciation on boiler plant costing $15,000	1,125.00
Total	$3,227.00

COST WITH USE OF SOFTENED WATER.

10% interest and depreciation on softening plant costing $3,500	$350.00
Boiler repairs	50.00
Chemicals at 1 ct. per 1,000 gallons	300.00
Coal for raising steam after cleaning, 16 tons at $1.50	24.00
5% depreciation on boiler plant costing $15,000.	750.00
Total	$1,474.00

The total saving in a single year is, therefore $1,753, which is practically half the cost of installing a softening plant.—Press Bulletin, U. S. Geological Survey.

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The reduced volume of railway traffic which has distinguished the past year has had at least one gratifying result. The number of casualties on the rail has fallen off in even greater proportion. Accident Bulletin No. 28 of the Interstate Commerce Commission, just at hand, shows that in the year ending June 30, 1908, less than half as many passengers were killed in train accidents as in the previous year. Of course a large part of this great falling off is purely fortuitous. The real ratio of improvement in the safety of travel is probably better represented by the figures for the total of employees and of passengers killed and injured from all causes, which is as follows:

Year Ending June 30.	No. of Passengers Killed.	No. of Passengers Injured.	No. of Employees Killed.	No. of Employees Injured.
1905	537	10,040	3,261	45,426
1906	418	11,185	3,807	55,524
1907	647	13,597	4,353	62,689
1908	406	12,645	3,358	56,344

While fewer travelers and fewer employees in a year of business depression account for part of the reduction in casualties, probably more is due to the fact that Superintendents have had an opportunity to weed out their forces and discharge inefficient and careless men. Besides this there has been less crowding of trains on the road and in the yards, and no need for keeping rolling stock in service while unsafe to run.

The questions relating to the influence of forests on stream flow, raised by Col. H. M. Chittenden in our issue of Oct. 29, receive some interesting discussion in the letters published on another page of this issue, and also in the report of the State Water Supply Commission of Pennsylvania, which we abstract this week. Of particular interest is the evidence showing the erosion resulting from deforestation in the Province of Quebec. We are sure that this instance could be matched by illustrations within the experience of very many of our readers.

It will not have escaped attention, we are sure, that Col. Chittenden's theories, if they were well founded, would have a most important bearing upon the problems of water-supply engineering, as well as those of the irrigation engineer. In fact, Col. Chittenden, in the article referred to, went so far as to say that the forests which clothe the summits of the mountains in the Far West were an injury rather than a benefit to the irrigators in the valleys below. In the same way, if Col. Chittenden were right, a drainage basin furnishing a water-supply to a city had better be cleared fields than covered with forests. Surely, these conclusions are so contrary to common sense and common observation of all intelligent men, that they cannot be given any serious weight in settling questions of practical policy. It is a matter of common observation that streams flowing from a watershed covered with primeval forest remain clear and limpid even in times of heavy rainfall; whereas streams flowing from similar areas with similar slopes which are cleared are always roily in times of heavy rain. Certainly, therefore, the cities which have taken pains to encourage forestation on the basins from which they draw their water-supply have made no mistake.

Another matter deserving some attention in Col. Chittenden's paper, to which we did not allude at the time, is his statements regarding the influence of flood erosion upon agriculture. The fact was clearly brought forward at the Conservation Conference held in the White House last May, that the human race is absolutely dependent for existence upon the thin layer of fertile soil which covers all arable lands. The effect of erosion is continually to destroy this layer of soil and take away its fertility on all the steep slopes; and while to some extent the flood waters do fertilize the bottom lands in the valleys, it is wholly insufficient to compensate for the loss sustained by the lands in the highlands. Further than that, the frequent effect of erosion is to cover up fertile soils with deep layers of barren sand and clay. We could cite actual instances where comparatively trifling streams have in the course of years covered up many acres of once fertile lands and rendered them non-productive. The late Professor Shaler, in his remarkable little book, which ought to be familiar to every engineer who aims to be well informed on the great question of the conservation of natural resources, points out that lands above a certain steepness, which are devoted to cultivation, will inevitably lose their fertility and become barren in the course of years. A forest growth, however, covers the steep slopes with a spongy layer, which retards the run-off and filters it to a certain extent; so that, whereas these same slopes would be a barren rocky or sandy waste if the forests were removed, they will under its protecting cover bear a continuous crop of timber if properly cared for.

A remark may also be ventured here concerning Col. Chittenden's claim that, while the natural forest may have an influence in retarding run-off, the forest under scientific cultivation where the debris is removed would not be equally beneficial. It is true, of course, that in some forests, particularly on the Pacific slope where processes of decay are very slow, the fallen timber and dead branches exercise a material influence in holding the moisture. But there is little of such primeval forest left in the Appalachian regions, and the time is not far distant when it will be all gone even on the Pacific coast. In the forest of the future, undoubtedly, the demand for wood products, and even for fuel, is likely to be such that dead trees and branches will be removed as they fall, as will the debris left by the lumbermen. But the really valuable mulch on the surface of the ground is that produced by the annual fall of dead leaves, and no forester, so far as we are aware, has ever proposed to remove these.

A NEWSPAPER CERTIFICATE OF SAFETY FOR THE BLACKWELL'S ISLAND BRIDGE.

We alluded last week to the fact that the technicalities in the expert reports on the Blackwell's Island Bridge had so muddled the newspapers, that some of them had interpreted the reports to be highly commendatory of that structure and reassuring as to its safety! These newspapers have been further bewildered by the remarkable deliverances of a technical contemporary, which has taken the position that the important thing to do is to get the bridge into use and reassure the public as to its safety instead of "fussing around over excess strains in a number of members"!

Illustrating the daily newspaper's muddled state of mind, we quote the following editorial from the New York "Times" of Nov. 14:

> The experts consulted regarding the safety of the Queensboro Bridge disagree between themselves in some respects, and their technical critics also disagree. Thus the "Engineering Record" regards the reports as satisfactory, while "Engineering News" views them with alarm. Under such conditions it behooves the untechnical person to disregard the engineers' patter about the radius of gyration, whatever it may be, and whatever it may signify, and to fix their attention firmly upon plain facts equally within the knowledge and estimation of all.
>
> It seems as though there was a margin of safety which has been overlooked. The bridge was designed for four elevated tracks, and the trouble is that now the experts report that the bridge is safe for only two elevated tracks. But there are no elevated railways at the Queens end of the bridge, and there is no reason to suppose that any Manhattan elevated will ever run over the bridge. On the contrary, it is likelier that the Manhattan elevated lines will be torn down than that elevated roads will be built in Queens. However that may be, it is certain that not within any time foreseen will there be any elevated road seeking access to the bridge which the engineers say is safe for the traffic of two tracks. It is a disappointment to learn that the bridge is of less capacity than had been hoped, but it is safe beyond any possibility of doubt for any traffic which will be put upon it within many years, so many that the future may be left to take care of itself, adequate and timely warning having been given.
>
> It must be understood that the question of safety arises not at all regarding ordinary traffic, but only regarding "congested loading" or the greatest load that can be imagined as happening, and such as is altogether unlikely to happen. If there never should be any elevated traffic, the lines provided for it could be used for trolley cars, whose weight is less concentrated and less trying to such structures.
>
> The grave responsibility which rests upon the technical journal to fairly and judicially interpret, and explain the significance of such reports as those on the bridge in question, will not, we are sure, escape the notice of our readers.

The "Times" remark that "the engineers' patter about the radius of gyration, whatever it may be" should be disregarded by the untechnical person, would be amusing were the matter less serious.

It might possibly interest the "Times" and its readers to know that the whole question whether the bridge is safe, even under the reduced loading now proposed, depends on that same "radius of gyration" and upon whether the engineers' "patter" concerning it is sound or unsound.

As to the "Times'" discovery of an overlooked "margin of safety," it may be excused for saying the bridge was "designed" for four elevated tracks, since the bridge ought to have been, and everybody supposed it was, so designed. But from the stress sheet published this week, it looks very much as if the additional elevated tracks were put on about as an Arab would toss an extra bundle on a patient camel's back!

For the "Times'" information we will say that if those four elevated tracks were put in place and the loads specified in the contract for the bridge were applied, there are members in the structure which would be strained beyond the elastic limit of the metal.

But the "Times" thinks that there is safety because the bridge was designed for a "congested loading" or a load "altogether unlikely to happen." We cannot leave our daily contemporary even that comfort, because on a cantilever bridge, a congested loading is by no means so unlikely. We would explain to the untechnical editor that on a cantilever bridge it does not take a crowd of trains and cars and people the whole length of the span to produce maximum stresses as on a suspension bridge. On the contrary, mere bunching of traffic on two or three short sections of the bridge will stress some parts of the bridge to the limit.

The "Times" assumes a very grave responsibility when it says that the bridge "is safe beyond any possibility of doubt for any traffic which will be put upon it within many years;" but the technical authorities which have misled it into such a position have taken an even graver burden of responsibility.

CONCERNING HIGH UNIT-STRESSES IN STEEL BRIDGE DESIGN.

A year ago, at the suggestion of a number of engineers who recognized a rapidly growing tendency toward high unit-stresses in steel construction, we discussed in these pages the subject of unit-stresses and pointed out that various considerations imperatively dictate large margins of safety. We venture to recur to this important subject at the present moment, when the investigation of the Blackwell's Island Bridge forcibly illustrates what dangers may lurk in high stresses. It has been shown that the structure as built is so weak, or in other words the intended loading so high, that the specified safe unit-stresses would be exceeded by 25%, 33% and in a few members even 47%! Now, as Professor Burr remarks in his report:

> These greatest overstresses, running with two or three exceptions not above a maximum of 25% of the stresses permitted under the specifications, *would not be serious if the permitted working stresses were not initially high.*

That is to say (since the observation, if it has merit at all, may be generalized) conservative unit-stresses put us in a position to feel much easier about the possible effects of errors in calculation.

Obviously this is one reason for avoiding high unit-stresses. But it is by no means the strongest reason, and indeed we believe it to be a very bad reason, since decent engineering practice neither requires nor permits a margin for faulty or slipshod calculation. As this, however, is in a sense a matter of opinion rather than fact, its further discussion may be dispensed with. The fact remains, as Professor Burr points out, that it would have been very fortunate and a source of much present satisfaction if the engineers responsible for the design of the Blackwell's Island Bridge had chosen considerably lower working stresses.

Since, in discussing high unit-stresses, we must needs refer again to this particular structure, let it be said that the alarmingly excessive stresses revealed by the investigations are not intentional, and cannot be said to have the approval of the Department of Bridges of New York City. As to how they came to exist, no official explanation has been forthcoming; but it is entirely safe to say that no engineer, inside or outside the Department of Bridges, believes that on the showing of the stress sheet it is safe to subject the bridge to even the working loads prescribed in the design. The engineers of the Department will certainly not advocate higher unit-stresses than those fixed in the specifications.

These specified working load stresses, however, are themselves unusually high. It is true that in the investigation to determine the maximum permissible loading, both Prof. Burr and Boller & Hodge have used these high stresses, but the former asserts his belief, in unmistakable terms, that the specified stresses are *higher than it is prudent to use* in designing. Boller & Hodge do not express an opinion on this point, though their report suggests the inference that they would themselves employ more conservative stresses.

Substantially the same high stresses were adopted for the ill-fated Quebec Bridge:

> The maximum unit stresses that Mr. Cooper proposed to use were about 21,000 lbs. per sq. in under ordinary loading and 24,000 lbs. per sq. in. under extreme conditions. He considered that the extreme conditions as specified would never occur. [The "extreme conditions," therefore, are directly analogous to the "congested loading" of the Blackwell's Island Bridge.—Ed.]
>
> By reference to the table it will be seen that the specified stresses for the Quebec bridge under working conditions are in advance of current practice and we believe that *they are without precedent in the history of bridge engineering.* Under extreme conditions the Quebec bridge stresses are in general harmony with those permitted in the Blackwell's Island Bridge. [Report of Royal Commission on Collapse of Quebec Bridge, p. 148.]

They are indeed "without precedent," but only because of the exceptional dimensions of the structure in which they were used. Differences in magnitude being allowed for, many other bridges of the recent past are designed for stresses equally unusual.

Indeed, if one looks beyond these two isolated examples of bridge design, and reviews the trend of bridge engineering during the past decade, the observer is impressed with the fact that there has been a rather general tendency toward using higher unit-stresses than were current in the previous period. No one, of course, has gone quite as far as was done in the two cases cited; yet these two are nothing more than pre-eminent instances of the prevailing drift. The working-load stresses of 21,000 and 20,000 lbs. per sq. in. specified for the two huge cantilevers are directly in line with the 17,000 to 20,000-lb. stresses fixed for numerous bridges of quite ordinary proportions.

If these facts be granted, we are bound to put to ourselves the question: Are there any good grounds for the increase in unit-stresses? If the movement is based on sufficient reasons, surely these reasons should be widely known, and should long have been proclaimed publicly as evidences of notable advance in the art! But we recall no statement of the kind; no one, so far as we know, has proffered a public justification of the modern unit-stresses as against those of the middle '90's. If, on the other hand, there are no reasons or insufficient reasons for the increase, it is even more important that the fact be known.

Frankly we do not believe that any good reason can be found for the upward trend of unit-stresses in bridge practice. We are unable to discover essential change in any one of the elements which affect permissible unit-stress.

As to quality of material: Commercial bridge steel of today is substantially the same as that of fifteen years ago. Its ultimate strength, elastic limit and ductility have not been improved, nor is the uniformity of the modern product any greater. Instances of brittle steel have not been unknown during the last five years, and on this score also no advance can be claimed.

As to loads: The only influential factor is the expectation as to future increase of load (on railway bridges). In the early '90's it was recognized that engine and train weights were increasing continually, so that a bridge might during its normal life be required to carry loads much greater than those current at the time of its construction. But in this respect we are no better off today. Almost every year of the last decade has given us a new "heaviest locomotive," and a limit to the advance cannot yet be fixed, especially if rail improvements in prospect materialize. And a very similar remark might be made as to train loads.

It appears, then, that neither on the score of improvement in steel, nor on the score of load contingencies is it possible to allege any reason why higher stresses should be allowed today than were warranted a dozen or fifteen years ago.

Nor have our methods of stress analysis advanced in accuracy to account for a decreased allowance of margin of strength over computed stress. The entire armament of the bridge designer was already developed a quarter century ago. The methods used in the 90's are the same as are used today. Secondary stresses have received no increased attention. In no way can we find that present-time stress calculations give a closer approximation to the tax on the structure than those of the earlier period.

And lastly, there has been no advance in the way of full-size tests of members or entire structures. Our first-hand knowledge of the correspondence between calculated strength and real strength has not been improved, and no warrant of more definite knowledge exists for a decreased safety-margin.

To sum up: There is no difference between the conditions of fifteen years ago and the conditions of today, as concerns permissible unit-stresses. If the old stress limits of 13,000 to 15,000 lbs. per sq. in. were proper, the limits now employed are excessive. Conversely, if the modern specifications are justified, bridge engineers of the early and middle nineties were very backward in utilizing the capacity of their material, and their structures have unnecessary strength. As to the latter alternative, no more can be said than this: it has not been proven. The bridges of the earlier period have stood, but we have not heard it asserted, much less proved, that they are needlessly heavy or wasteful of material. The absence of proof is significant, and puts the burden of justification on the advocates of the high unit-stresses now current.

While thus no valid *reason* for the upward tendency of stresses is discernable, it is not difficult to find the *causes*. And these causes, or at least two of them, are of a peculiar character that demands a brief examination.

A first cause may be seen to reside in the fact that the earlier bridges have stood and have shown no signs of distress under the loads. No important failure or accident is on record against reputable bridges of that period, so far as we recollect. A continuing record of this kind naturally breeds confidence and venturesomeness. The designer might plausibly reason with himself: "These bridges, calculated for unit-stresses of 14,000 lbs., having performed admirably, I may safely advance to 15,000." The progression is easy, if gradual, but it is not self-limiting, and leads on insensibly to excess. And in fact the increase in unit-stresses has been gradual; no abrupt changes have occurred, and the forward movement has been all but imperceptible.

This cause is so obvious as to its manner of influence and as to its ultimate result that it hardly needs mention here, except to make our list complete. On the other hand, the two further causes of the increase of allowed unit-stress as we conceive them, are much less plain.

The first is the influence of specifications drawn for exceptionally large bridges upon general bridge specifications. It is apparent that such influencing does take place, since exceptional structures always receive much public discussion, their design is a matter of general interest, and their specifications are naturally considered to be models of excellence and weighty precedents for the design of other structures. The special character of the unit-stresses fixed for their proportioning is not remembered as easily as the stresses themselves. When the specified stresses are higher than found in ordinary practice, many an engineer will unconsciously conclude that he himself has been unduly conservative, and that up-to-date practice sanctions increased unit-stresses.

Even when the engineer would stick to the safe side, his employer may insist that the steel which he pays for shall take the heavier loading. "Did not these engineers of great fame advise high unit-stresses for this or that huge structure? Who are you to put your opinion against theirs?"

That there are such essential differences between very large bridges and ordinary bridges as to permit different unit-stresses for the two, is something like an axiom, in bridge engineering. It is held that higher stresses are allowable in very large bridges. So widely is this believed that citation of authorities seems unnecessary; yet an apt passage in the report on the Quebec Bridge Inquiry is worth notice:

> We have already indicated that the dimensions of the Quebec bridge were such that the use of the highest safe unit-stresses was justifiable and good engineering practice. If we were sure that the loads were correctly estimated, that the stresses acted in the bridge exactly in accordance with the assumptions and that the elastic limit of the built-up members was not less than 32,000 lbs. per sq. in., 24,000 lbs. per sq. in. would not be an unsafe stress for structural steel, provided that the material is regular in quality and the details satisfactorily worked out to suit such a stress. [Report of Royal Commission on Collapse of Quebec Bridge, p. 148.]

What foundation there may be for allowing higher stress in a very large bridge than in small ones need not be discussed here. There are some opposing considerations. Thus, in the above quotation the clause "If we were sure . . . that the elastic limit of the built-up members was not less than 32,000 lbs. per sq. in." touches on a matter wherein the bridge of ordinary size is on much safer ground than the very large bridge. Full-size tests of such members as are used in the smaller bridge have been made, but no tests of the much larger members of the other. On this account more must be allowed for uncertainty, in the case of the large members. But there is on the other side the immensely important consideration of impact and related effects, which demands a very large allowance in the unit-stresses of ordinary bridges. We know with practical certainty that in very large bridges the impact effect practically disappears for the main truss members.

This fact together with some others, as the reduced effect of unforeseeable load contingencies, etc., is probably sufficient to justify the use of higher unit-stresses in bridge structures of great size.

Be this as it may, the general acceptance of the view that they are justified is undeniable. And this means that when the engineer reads the specifications drawn for an exceptional bridge, he must constantly be on his guard against permitting himself to regard their unit-stresses as models. This is not always done. The published stress specification for the Quebec and Blackwells' Island bridges will undoubtedly tend to give a forward impulse to the rise of unit-stresses. We trust that all such influence may be neutralized, and, if possible, that the present discussion may contribute to this end.

The second of the two special causes for the increase in unit-stresses is a recent one. The report of the Commission of Experts on the design of the Manhattan suspension bridge published in 1903,* has, we believe, exerted a distinct influence in the direction of less conservative stressing. Doubtless no such effect was intended or desired by any member of the Commission. More than this, we believe that this influence is based wholly on a misinterpretation of the Commission's statements.

It is to be particularly noted that the Commission did not fix or recommend any unit-stresses in figures. What it actually said concerning them was as follows:

> We consider that the bridge should be so proportioned that with the congested load of 16,000 lbs. per lin. ft., covering the whole bridge, combined with dead load and wind pressure, no stresses would be produced anywhere reaching the elastic limit of the material or impairing the stability of the anchorage. In other words, it should not be possible for such extraordinary congested load to do any permanent injury to the bridge. [Report of Commission on Manhattan Bridge, Eng. News, March 12, 1903, p. 243.]

A somewhat fuller statement of the same thought was given by Mr. C. C. Schneider, a member of that Commission, in his special report on the design of the Quebec Bridge, written less than a year ago, as follows:

> If we knew all the strains occurring in a member of a structure, and if the material and workmanship were perfect, we could allow strains up to the true elastic limit of the material. These ideal conditions of material and workmanship, however, cannot be realized in practice, and in addition to the computed direct strains on which the proportions of the members are based, there are secondary strains produced by the bending from their own weight and deformation of the trusses under load. Allowance must, therefore, be made for these contingencies in determining on unit strains which may be considered within the limits of safety. [Report of C. C. Schneider on Collapse of Quebec Bridge, in Report of Royal Commission, p. 155.]

His meaning is still more specifically expressed farther on in his report, where he has occasion to select unit-stresses for his analysis of the bridge. He selects basal stresses of 21,000 lbs. per sq. in. for the ordinary load, and 24,000 for the extreme load. It will be observed that the latter figure is by no means up to the elastic limit of the metal; yet even so it is higher than Mr. Schneider would use in his own work, for he adds the significant remark:

> The writer does not advocate these high unit strains, but only desires to fix a limit within which the strains may be considered safe, and which could be used in comparison with the tables in Appendix B. [p. 156.]

Besides this, it is to be noted that the Commission of 1903 were not discussing bridge stresses in general or bridge construction in general when they made the recommendation quoted above. Their report was directed solely to the question whether the design of Mr. Gustav Lindenthal for the Manhattan suspension bridge consisting of a chain of nickel-steel eyebars was to be approved as safe. To apply their conclusions and recommendations to a wholly different type of structure is therefore quite unwarranted.

We deem it a duty to call particular attention to this report of the Commission of 1903 because an attempt is just now being made to place upon this Commission the responsibility for the high stresses and even to excuse the serious over-stresses in the Blackwell's Island Bridge. Prof. Burr in his report printed in our last issue said:

> I cannot concur in the opinion of the Commission of Bridge Experts that a possible combination of loads should be permitted to produce stresses just under the elastic limit.
>
> * * * * * * * *
>
> Computations * * * show that the stresses produced by the prescribed congested live load combined with the dead load are higher than prescribed as permissible in the specifications and higher than prudent to permit, although practically not in excess of the limits approved by the Commission of Expert Engineers in 1903.

The head of the Commission of 1903 was the late Geo. S. Morison. We can imagine what he would say, were he still living, to the charge that he approved of unit stresses "just under the elastic limit," or that such stresses as 35,000 lbs. per sq. in. in a riveted tension member are "not in excess of the limits approved by the Commission of 1903."

The important point, however, is that such a statement ought by no means to go unchallenged and uncontradicted. The harm it may do cannot be foretold. Engineers are already under pressure enough to go to the limits of safety in their designs without circulating the story that eminent leaders of the profession have advised that metal may be safely stressed to a point "just under the elastic limit."

Careful reading of the report of the Commission of 1903 shows that the Commission nowhere advised that unit-stresses for ordinary working loads might be raised. It merely advised *as an additional safeguard*, that one particular great bridge should be proportioned, not only for a working load assumed in the ordinary manner, but also for the greatest load that could possibly be placed on the structure, and that the unit-stresses produced by such loading might properly be permitted to be assumed higher than for the ordinary loads.

*Engineering News, March 12, 1903, p. 243, and July 2, 1903, p. 24.

LETTERS TO THE EDITOR.

Useful Special Method for Finding Centers of Gravity.

Sir: The following method, which I have never known to be used, lends itself quite readily to the determination of the center of gravity of an area or of a line.

According to principles in mechanics the area of a surface of revolution is equal to the length of the line whose revolution generates the surface, times the distance its center of gravity moves in one complete revolution. In the same way, the volume of a solid of revolution is equal to the area of the radial section times the distance its center of gravity moves in one complete revolution.

Take for example a wire bent in the form of a half circle, whose length is equal to πR. Denote by C the distance of the center of gravity of the wire from the axis of revolution. Then the surface of the sphere generated by rotating the wire about the diameter of the circle, which we know to be $4 \pi R^2$, is also equal to $\pi R . 2 \pi C$. Equating and solving for C, we find

$$C = \frac{4 \pi R^2}{2 \pi^2 R} = \frac{2 R}{\pi} = \frac{D}{\pi}.$$

To find the center of gravity of a semi-circular sheet: The volume of a sphere, which we know to be $\frac{4}{3} \pi R^3$, must also, according to Mechanics, equal $\frac{\pi R^2}{2} . 2 \pi C$, where C is the distance of the center of gravity of the sheet from the straight side of the sheet. Equating and solving for C,

$$C = \frac{4}{3} \frac{\pi R^3}{\pi^2 R^2} = \frac{4 R}{3 \pi}.$$

Although this method cannot be applied to all cases as easily as in these, it is nevertheless convenient to use in a number of simple problems. In short, the center of gravity of any line can be easily found if we know the area of its surface of revolution; and the center of gravity of any area can be easily found if we know the volume of its solid of revolution.

W. F. Schaphorst.

Agricultural College, New Mexico, Oct. 23, 1908.

Calculating the Intersection of Any Two Grade Lines.

Sir: While engaged in locating in the mountains of Mexico, a number of years ago, I often had occasion to produce two long fixed grade lines to an unknown intersection. To shorten this work I devised the following simple formula which may be of interest to some of your readers as it quickly gives the elevation at the *P. I.* of any two grade lines, regardless of their algebraic signs.

As indicated in the accompanying sketch, let

El.X = elevation in feet of the unknown intersection of the two grade lines *AX* and *BX* (or *CX*).

El.A = elevation in feet at point of beginning of one grade line.

El.B (or *El.C*) = elevation in feet at beginning of other grade line.

R_1 = gradient of *AX*.

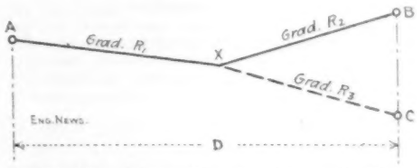
R_2 (or R_3) = gradient of *BX* (or *CX*).

D = horizontal distance, in feet, between *A* and *B* (or *C*).

Then

$$D = \frac{\text{Diff. between } El.A \text{ and } El.X}{R_1} + \frac{\text{Diff. between } El.X \text{ and } El.B \text{ (or } El.C)}{R_2 \text{ (or } R_3)}$$

If, in substituting in the equation, care is taken to place the elevations so that the smaller ones are subtracted from the larger ones, then all gradients are to be taken as positive quantities. The equation is readily solved for *El.X*.



Finding the Intersection of Two Grade Lines.

Example.—Given $D = 2{,}000$ ft.; $El.A = 1{,}450$ ft.; $El.B = 1{,}452$ ft.; $R_1 = .005$ and $R_2 = .006$, both grades descending toward the unknown point. Then by the formula,

$$2{,}000 = \frac{1{,}450 - El.X}{.005} + \frac{1{,}452 - El.X}{.006}$$

$$.06 = .006\ (1{,}450 - El.X) + .005\ (1{,}452 - El.X).$$

$$= 8.7 - .006\ El.X + 7.26 - .005\ El.X$$

$$= 15.96 - .011\ El.X.$$

$$15.90 = .011\ El.X.$$

therefore $El.X = 1{,}445.45$.

The horizontal distances from *A* to *X* or *X* to *B* are easily found, as follows:

$$AX = \frac{1{,}450 - 1{,}445.45}{.005} = 909.1.$$

$$BX = \frac{1{,}452 - 1{,}445.45}{.006} = 1{,}090.9.$$

Yours truly,

Arthur J. Rector,

Engineer, K. C., M. & O. Ry.

Kansas City, Mo., Sept. 30, 1908.

Forests and Stream Flow in New England.

Sir: Your editorial in the issue of Engineering News for Oct. 29 on the "Relation of Forests to Stream Flow" accords so well with our experience and observation in this region that it seems proper to submit a bit of corroborative testimony.

In this upper valley of the Connecticut at a point (lat. 43¾°) where there is about 3,200 square miles of drainage area above us, the facts are as follows:

1. There has been no marked change in the mean annual precipitation since about 1835, although of course there have been cycles of dry years and wet years.

2. There has been no noticeable increase in the river floods. In fact, the highest flood which the writer ever saw here occurred more than twenty-five years ago, and nothing has since anywhere nearly reached the level of the record flood of 1869.

According to the testimony of the oldest inhabitants, there is probably more woodland throughout this section of country than there was fifty years ago. In all directions old pastures are growing up to white pine. The writer has made a few feeble attempts at reforestation and finds that, unless large expense is incurred, Nature, left to herself, will outstrip him five acres or more to one in the neighborhood of other woodlands. It must be understood, however, that there is probably little or no primeval forest left. Former generations have cut over the woodland, as the present one is doing; but the average maturity of the existing forest is probably less than twenty-five years ago. Thirty years ago, more or less, the wood-burning locomotive made large demands upon the forest; and today that is followed by the cuttings for the pulp mills; but the latter is more discriminating, since the hard woods are not wanted.

Again, as an officer of the water-works company constituted by Dartmouth College and the village precinct jointly, the writer has made particular observations over the two square miles of area tributary to the reservoir (34 acres water surface), all of which the company owns or controls. He has traversed this area during the progress of rain storms and at the time of maximum flow from the streams and has noted the following facts: A large district consisting of meadow upland, pasture, and mixed woodland has a comparatively thin and spongy topsoil two or three feet thick overlying an impermeable clay hardpan. This part mainly has a rather steep slope, i. e., 30 to 45 ft. per 1,000. From surface observations the run off is most uniform from the grassy meadows, but the percolation is doubtless considerable.

The pastures are uneven in surface and hold the water in pools so that the run off is less regular, and probably the percolation is less, although that is undetermined. The woodland is generally rough and uneven in surface interspersed with boulders and hummocks and, during the height of the rain, abounds in many pools and slough-holes, which retard the flow at the time, but which continue to feed the brooks for a considerable period afterwards. But the territory as a whole retains like a sponge a large volume of water which finds its way into the reservoir by percolation and seepage during many following days or even weeks.

Another portion of the district has steeper hillsides with outcropping ledges of decomposing slaty rock, and here the general run-off is much more rapid; but the grassland and pastures and woodland alike retain a very considerable amount of the rain-fall, which maintains for a long time good springs of water. The whole territory is of such a nature that all percolating water is finally caught in the reservoir.

While these observations apply to special conditions in a hilly country—altitude from 700 ft. to 1,300 ft. above sea level—doubtless the same observations could be made over other and much wider areas tributary to the Connecticut River. After more than thirty years of familiarity with the climatic conditions of the region, the writer would say that, although in hearty sympathy with the entire movement for conservation of the forests by all proper and reasonable measures, he believes that the "cause" has been and is greatly injured by mistaken zeal of advocates who overstate their case. Let us have all the facts and duly apply them, but let us not be misled by hasty theoretical deductions of the doctrinaires.

Referring to the numbered statements you have criticized:*

(1.) Sometimes true and sometimes not. A growing crop, especially grass in a meadow, may retain more rainfall than a forest on equal area. Especially in the spring, when the fallen leaves are packed, after the pressure of the snow and ice. Hence the apparently more rapid drying off of "tillage" than of woodland may be due to deep permeability promoted by cultivation.

(2.) The conditions determining saturation are so many that such a sweeping general conclusion is not warranted.

(3.) In hot weather the temperature of forests is decidedly lower than in "the open," which would in itself cause less evaporation. As to the relative absorbing and evaporating capacity of grass and other crops as compared with that of trees, we need more facts before generalizing so confidently.

(4.) Not in accord with our experience. The forests are great conservators of the snow—hindering its evaporation and delaying the run-off.

(5.) This statement accords nearly with our experience, provided the ground is not too severely or unwisely burned over, by accident or to get rid of "slash" or brush.

(6.) Probably true of New England at least.

(7.) We have no definite observations, but have no reason to think that the average run-off is appreciably more or less than formerly.

Yours truly,

Robert Fletcher,

Pres. and Engineer of Hanover Water-Works Co.

Hanover, N. H., November 2, 1908.

The Relation of Forests to Stream Flow in Quebec.

Sir: Will you allow me to say a few words in regard to Col. Chittenden's article on Forests and Floods in your issue of Oct. 29.

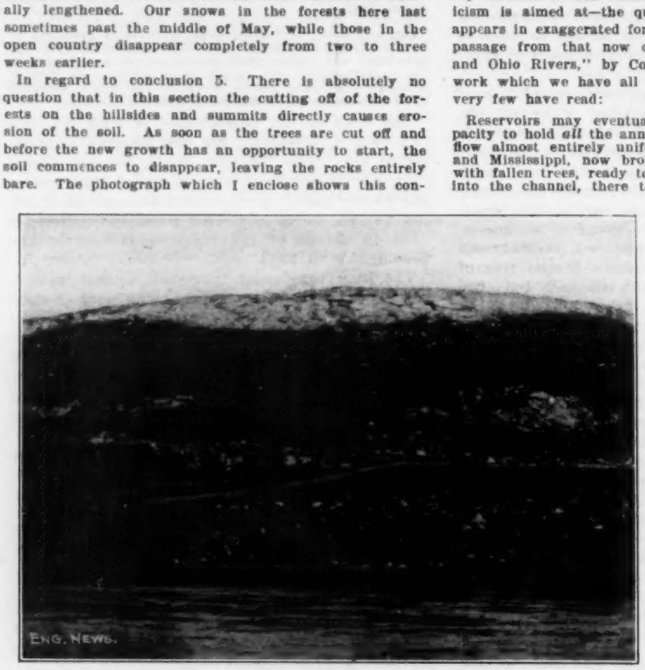
For the past four years I have observed closely the relation of forests to stream flow and I cannot agree with Col. Chittenden's conclusions.

In regard to No. 2. I find that water, even after complete saturation of the forest floor, flows off more slowly from the woods, owing to mechanical obstruction of the litter, than from land which has been burned over or which is bare. In my opinion water which falls on land which has been burned over and on which grass and brush have come up not only evaporates more quickly, but also runs off much faster than from normal forest. In regard to the accumulation of water held in different parts of the forest giving rise to flood conditions, this is purely a matter of the topography of the country and has nothing to do with forest lands as opposed to unforested.

In regard to conclusion 3. I believe that forests to some extent influence precipitation, and that the evaporation from such territory perhaps induces more frequent rainfalls. All through the drought of this summer, in the territory under my direct observation, covering an area of 10,000 square miles, the sections which were well forested had frequent local showers while the territory adjacent to cleared lands was absolutely dry.

In regard to conclusion 4. I believe it to be entirely erroneous. Unquestionably the melting of the winter snows is much retarded by the shade of the evergreen trees, but the time taken for the snow to melt is actually lengthened. Our snows in the forests here last sometimes past the middle of May, while those in the open country disappear completely from two to three weeks earlier.

In regard to conclusion 5. There is absolutely no question that in this section the cutting off of the forests on the hillsides and summits directly causes erosion of the soil. As soon as the trees are cut off and before the new growth has an opportunity to start, the soil commences to disappear, leaving the rocks entirely bare. The photograph which I enclose shows this condition much better than words can describe it. It all depends on the character of the growth which springs up after the deforestation whether or not the soil is retained. In any case the evaporation is so much more rapid from land covered with brush, briers, etc., than from land well forested, that the soil becoming dry under the influence of the wind and sun is much more easily eroded and removed by heavy showers. This is particularly true of sandy soil such as occurs throughout this region.



AN EXAMPLE OF EROSION ABOUT 14 YEARS AFTER REMOVAL OF THE TIMBER.

Col. Chittenden may be right, as you say, in regard to the large rivers whose headwaters are in the Rocky Mountains, but his conclusions are certainly erroneous for this section of the country.

Very truly yours,

Elwood Wilson.

Supt. Forestry Division, Laurentide Paper Co.

Grand Mere, P. Q., Nov. 4, 1908.

Forests, Stream Flows and Storage Reservoirs.

Sir: In your eminently fair criticism of my recent papers on the relation of forests to stream flow, published in your issue of Oct. 29, there are two respects in which my argument has possibly been misunderstood.

There can, of course, be no objection to the establishment of forest reserves in the Appalachians wherever the topography is of a character to satisfy the essential conditions of such reserves. Omitting certain incidental advantages of forests, the primary and controlling purpose of their creation and maintenance at public expense is the timber which they are to furnish. Altogether secondary and subordinate is the uncertain influence which they may have upon stream flow. This proposition will no doubt be slow of acceptance, but I believe it must prevail in the long run. If it is correct, and if our future forest reserves are to be established solely with reference to their use as a source of timber supply, then there are unquestionably extensive areas in these mountains that are not nearly as well adapted to this purpose as are available lowland areas of vast extent in various parts of the country.

In the matter of reservoirs your criticism has given me the impression that you consider my papers upon the whole hostile to the reservoir idea. This was not my intention. The storage of our waters for various uses—power, domestic supply, navigation on canals and the smaller canalized rivers, maintaining the purity of small streams in periods of drought, etc.—is a matter of the very highest importance and one justifying thorough consideration by the public authorities. The adverse ground taken in my argument relates solely to the exaggerated claims put forth for the beneficial effects of reservoirs in controlling floods and maintaining navigation on our larger streams. Even in this case it is not intended that such larger control might not be physically possible, but that its vast cost makes it impracticable. The same or better results can be realized by other methods at far less outlay. It is only these visionary features of the reservoir propaganda that my criticism is aimed at—the quixotism, if you please, which appears in exaggerated form in the following remarkable passage from that now classic work, "The Mississippi and Ohio Rivers," by Col. Charles Ellet, Jr. (1853)—a work which we have all heard a great deal about, but very few have read:

> Reservoirs may eventually be made of sufficient capacity to hold *all* the annual excess, and render the daily flow almost entirely uniform. The banks of the Ohio and Mississippi, now broken by the current and lined with fallen trees, ready to be swept by the next freshet into the channel, there to form dangerous snags, may yet, in the course of a very few years, be reclaimed and adorned down to the water's edge. In the opinion of the writer, the grass will hereafter grow luxuriantly along the caving banks; all material fluctuations of the waters will be prevented, and the level of the river's surface will become nearly stationary. Grounds which are now frequently inundated and valueless, will be tilled and subdued; the sandbars will be permanently covered, and, under a uniform regime of the stream, will probably cease to be produced. The channels will become stationary. The wharves will be built as the wharves on tidewater, with little, if any, reference to the fluctuations of the surface. The lower streets of all the river towns, no longer exposed to inundations, will acquire new value. The turbid waters will be arrested in the upper pools, and the Ohio first, and ultimately the Missouri and Mississippi, will be made to flow forever with a constant, deep and limpid stream. The ice will be swept off as it forms, and neither cold nor droughts will longer be suffered injuriously to affect the navigation. The ocean steamers will not then be confined to tide-waters, but will be able safely to ascend the living streams to seaports on their borders, and the extent of the inland navigation will be limited only by the limit to the water which is supplied by the atmosphere.
>
> All this may be accomplished on the Ohio for about the cost of three or four ships of the line [say half a million each, including armament]. The great and only difficulty is, so far to overcome the cold incredulity of the public as to obtain from Congress a sufficient appropriation for the completion of the first two reservoirs. This once effected, and a single practical demonstration made, it will perhaps be as difficult to convince the future engineer that a thing so clear and palpable could ever have been doubted, as it at first was to remove the doubts.

Very truly yours,

H. M. Chittenden.

U. S. Engineer's Office, Seattle, Wash., Nov. 5, 1908.

Gravel Ballast for Railway Track—Occurrence of Floods in Australia.

Sir: I have just been reading in your issue of Aug. 6, 1908, p. 148, an interesting article on the use of gravel ballast.

I may say that here in Queensland, as well as in America, we use gravel ballast very extensively, in fact, probably two-thirds of our lines are finished off with this material. I note particularly that Mr. Stafford states that it might be assumed that ballast should be entirely free from sand, and I agree with him entirely in his contention that such is not the case; a considerable quantity of sand undoubtedly improves the whole.

In Queensland we have large areas of rolling downs country somewhat similar to the prairies of America, the formation being basaltic and cretaceous. In periods of drought these soils crack to great depths, sometimes to many feet if the drought is prolonged, and to a width of several inches. It is found that where broken stone ballast is used on these classes of soil, cracks form beneath the ballast, and the road virtually "goes all to pieces" in dry weather, but if the stone ballast is filled up with sand and a width of, say 2 feet, on each side of the ballast is covered with not less than 6 ins. of the same, the results are surprisingly beneficial, and practically no cracking at all takes place. We are at present, I may say, as rapidly as means will permit, sanding many miles of our track.

I am now building a line 175 miles in length over the lower cretaceous rolling downs country, and the whole of this is being ballasted with sand. About half of this sand has been obtained from a pit situated almost in the center of the open plains, the discovery of which was purely accidental. The sand in this pit appears to be of unknown depth and illimitable quantity, and this is the more curious because the river beds do not contain a spoonful in miles. It is my intention on reaching the terminus, which is situated on a river bearing very large quantities of excellent gravel, to top the sand with gravel as quickly as possible, to prevent

*Engineering News, Oct. 29, p. 478.

the wear which takes place when the sand blows on to the rails and into the bearings.

It is most interesting geologically to note the instantaneous change of vegetation and general character which takes place with the geologic formation here, one having great treeless plains covered, in good seasons, with a most marvelous growth of waving grass, and not a stone for miles; the other (probably Devonian) being rocky with stunted trees and sparse grasses, with almost every mile of the Cloncurry River holding about half a million yards of ideal gravel. I send you a few photos exemplifying the contrasts, but I must explain they were taken towards the end of a dry season, except where water is shown. The watercourses are dry except in the wet season, and the rails were laid first, and the bridges, of which there are five miles, were built afterwards, and we were caught by an unusually early wet season.

Undoubtedly, as Mr. Tratman states in the article above referred to, it is economical to use plenty of gravel, or stone either, for that matter, if finances will permit. Unfortunately, owing to the sparseness of our population, we are obliged to endeavor to build our lines as cheaply as possible. I have therefore limited myself to 5 ins. of sand under the sleepers, but this, with 2,640 7-ft. 9 × 4½-in. sleepers per mile, and our comparatively light loads, (8 tons to each axle), enables us to maintain the line in fairly good order and at very low cost. The main feature, however, is the success of sand in stopping the cracking of the soil under the ballast.

Yours faithfully,

W. Pagan,
Chief Engineer, Queensland Railways.

Brisbane, Australia, Sept. 17, 1908.

[With his letter Mr. Pagan forwarded a number of large and fine photographs of the country along the line of the Queensland Railways, but lack of space prevents us from presenting all of them. We do show, however, four views illustrating the different formation noted in the letter and also a portion of the flooded region.

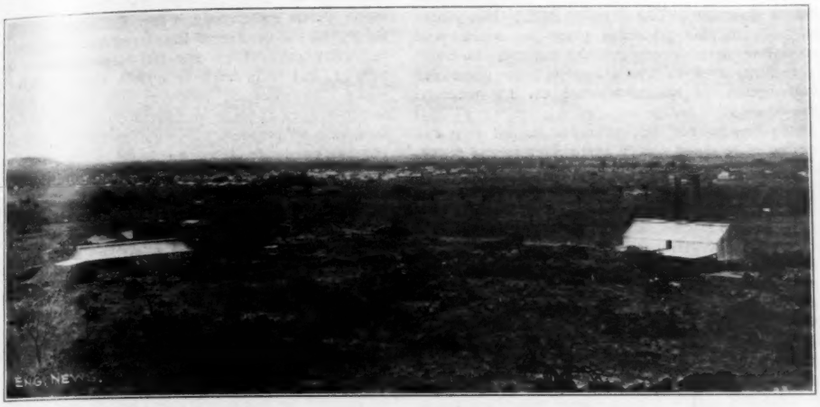


Fig. 1. Treeless and Stoneless Prairie.

Fig. 2. Rocky Uplands.

DIFFERENT TYPES OF COUNTRY ON NEW CLONCURRY RY., QUEENSLAND, AUSTRALIA.

Fig. 1 is a view overlooking the village of Cloncurry, with the "stunted trees and sparse grasses" and rocks. In contrast Fig. 2 shows the "treeless plains, covered with grass." In this latter view the camels, with their Afghan drivers imported to Australia, are engaged in carrying freight, supposedly before the construction of a railway. Mr. Pagan states that these camels are quite uncommon in Queensland, although they are frequently met with in western Australia. Fig. 3 shows the construction of a temporary bridge, replacing one recently washed out by floods, and in Fig. 4 is the same site some eight hours later, in which short time the river rose in a flood, which washed out the temporary cribwork and cleaned off the drift from the banks, and subsided to its original level. At this place the crossing was washed out ten times in one month.—Ed.]

Fig. 3. Building New Crossing.

Fig. 4. Washed Out Eight Hours Later.

THE VICISSITUDES OF RAILWAY CONSTRUCTION IN AUSTRALIA.

Notes and Queries.

In the article on the "Closure of the Charles River Dam" in our issue of Nov. 5, it should have been stated that Mr. Geo. B. Francis, M. Am. Soc. C. E., acted as Consulting Engineer on the revised design for the shut-off dam.

The note on cable railways in Chicago, in our issue of Nov. 5 (p. 500) might give the impression that cable railways are still in operation in that city. As a matter of fact they were abandoned in 1906 (Eng. News, Sept. 20, 1906), and the note in question referred only to the reconstruction of the old tracks having cable conduits. This work was described in our issue of Nov. 7, 1907.

In the paper on the "Analysis of Water for Its Mineral Content," published in our issue of Oct. 1, an error occurred on p. 357 at the bottom of the middle column through the transposition of the words "hard" and soft." The correct reading is:

(1) Soft Scale: H not more than .25.

* * * * * * * *

(3) Hard Scale: H more than .5.

ANNUAL CONVENTION OF THE ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION.

The 26th annual convention was held Nov. 10, 11 and 12 at the Blatz Hotel, Milwaukee, Wis. About 65 members and a number of visitors were registered, and there was a fair exhibit of track material and appliances. There were seven sessions held, but an unreasonable amount of time was lost in casual speeches and other irrelevant matter, the regular proceedings being frequently interrupted to give visitors or others a chance to "say a few words." The program included three committee reports, three papers and seven topical questions. The reports and papers were read, but only three subjects were discussed and the topical questions were omitted. The discussions were free, the remarks relating more to personal practice and experience than to general principles or conditions. The entertainments included trolley rides around the city and an illustrated talk on Milwaukee, this last being followed by an informal reception.

The first session was called to order about 10.30 a. m., on Nov. 10, when addresses were made by Mr. D. S. Rose, Mayor of the city; Mr. R. H. Aishton, General Manager of the Chicago & Northwestern Ry., and by Mr. J. A. Kerwin, President of the association. The remainder of the session was devoted to brief addresses by various members and visitors. The following is a summary of the technical part of the proceedings, the first matter taken up being a committee report on claims due to fires and injuries to stock and employees.

PROTECTION AGAINST FIRES AND AGAINST INJURIES TO STOCK.

To guard against stock claims is to guard against the encroachment of stock on the right-of-way. To effectually accomplish this, the entire line must be protected by good, substantial fences, first-class cattleguards and gates.

One of the most fruitful sources of stock claims is the difficulty of having farmers and others close their gates when not in actual use. Most states have laws covering such negligence, and a notice printed on strong linen cloth, fully setting forth the provisions of the law, should be posted on each gate. Before a farm crossing is established, the party to be served should be required to execute an agreement to keep the gate in repair and closed at all times when not in actual use, and to take every reasonable precaution to guard against accidents in driving stock across the right-of-way.

When feasible, all farm and public crossings should be established at points where a subway or overhead bridge can be constructed, and considerable expense to provide such crossings is warranted.

When there are ponds of water along the track, which cannot be drained, it is a good plan to locate the fence next to the track rather than fence them in. When stock want water, and it is in sight, they will generally go through or over a fence to attain their object.

In prairie country, where a running fire can sweep over a large territory there should be good fire guards plowed not later than June each year. This requires not less than four furrows, and to further guard against the possibility of fire breaking over them, two or three swaths should be mowed with scythes or mowing machines next to the furrows while the vegetation is still green. As soon as sufficiently dry it should be burned.

Fire guards, to be effective, should be so far from the track that the prevailing wind would not carry the sparks from a locomotive beyond them. This work can usually be accomplished at a nominal cost if the track men will make it a point to gain the friendship of the farmers and stockmen along their territory.

Where the growth is very heavy and much valuable property is exposed, it is a good plan to have a couple of farmers haul water and keep right along with the burning gang. A method used in western Kansas was to keep a work train with four or five water cars with the burning gang. The gang consisted of 12 to 15 section men, and the same number of stockmen. If the wind was favorable, both sides of the track were fired at the same time, beating out the back-fire with wet gunny sacks or by dragging green cow hides weighted down with small logs or pieces of bridge stringers.

With a few swift ponies and a supply of green hides weighted down and attached to long ropes these can be dragged over a fire when it gets beyond control of section men, and subduing it very quickly and effectually. Also the blow-off cock on the work-train engine can be brought into play, and a stubborn fire smothered out in its incipiency. In this way, by having water always at hand and plenty of help and facilities for keeping fire under control, good fire guards can be burned at the rate of ten miles per day.

In a prairie country the mechanical department should provide some sort of spark arrester on all locomotives during the late summer and fall. Firemen should be instructed not to shake the grates when the engine is passing hay or grass land or crossing bridges.

Where oil fuel is used exclusively for the locomotives, fires are practically unknown. Occasionally a piece of hot brick will drop from the arch and unless caught by the ash pan, a fire is likely to be the result. In rare instances sand used under forced draft for cleaning the soot out of the flues becomes so hot it will ignite the dry grass and weeds with which it comes in contact. When practicable this cleaning should be done when passing plowed fields.

The discussion turned largely on the laws of different states in regard to recovering damages for stock killed by trains; also on the methods employed by different railways in providing against accidents of this class and in handling the claims for damages. Mr. Rice remarked that in getting at the valuation of stock that have been killed he finds out what assessment has been given for taxes. On a certain part of one road no damages are paid, the land being obtained by condemnation proceedings and the farmers required to sign an agreement to keep cattle off the right-of-way. As they know they will have to stand any loss, they are much more careful as to keeping gates closed and fences in repair.

Mr. Tratman ("Engineering News") considered it useless to put upon the gate a sign setting forth the legal requirements and penalties, as recommended by the committee. Such signs are sometimes required by law, but nobody ever reads them. A conspicuous sign "Close This Gate; as Required by Law," would be much more effective. In Maine, the law prohibits the turning of cattle loose upon the highways, so that the railways are not much concerned about the use of cattleguards at road crossings. As to diverting the fence so as to leave a pond on the field or farm side, he thought that such a practice might lead to trouble. The fence is supposed to mark the boundary of the right-of-way. If the railway does not fence the full width of its right-of-way it may lose some rights (after a term of years). Thus, the future widening of an embankment might result in filling up the pond in question. The farmer might then claim this as a regular watering place for stock, and obtain damages or compel the railway to build a retaining wall to avoid encroaching upon the pond, which is really located on its original right-of-way.

As to fire guards, one member stated that his practice is to clear a 4-ft. strip next to the fence, and fires on the right-of-way cannot pass this. When a fire is started by an engine, the section foreman ascertains the number of the last train that passed (or the number of the engine) and telegraphs to division headquarters. The spark-arresting device of this engine is then carefully examined. Mr. Cornell (C. & N. W. Ry.) pointed out that grass should be kept cut around bridges.

As to personal injuries to track employees, the Chicago & Eastern Illinois Ry. has adopted an accident insurance system, the men paying a small portion of their wages until a fixed sum has accrued, after which they make no more payments. Mr. Tratman remarked that when a boarding train is set out on a special siding the switch should be spiked in order to prevent any accidental turning of a train into the siding and causing death or injury to the men in and around the cars. If the boarding train is to be stationed at one point for any length of time, the track connection should be taken up as a positive prevention against any accidental misuse of the switch. One member spoke of the danger of men standing up on the flat cars of a work train when the train is in motion. On the other hand, Mr. Cornell (C. & N. W. Ry.) spoke of the dangers of the men sitting on the sides of the car, where they are likely to be injured by passing trains or by obstruction at the sides of the track, such as the wing fences of cattleguards.

The report of the committee on the organization of the track department on a division was then presented, and some extracts from this are given below:

ORGANIZATION OF A ROADMASTER'S DIVISION.

A roadmaster should have a clerk, and the pay should be sufficient to secure a clerk who can take entire charge of office work, with the exception of the correspondence. A roadmaster should devote his time to work being done on his division. He should see his foremen daily if possible, but should not have stated times for going over the division. He should be on the work as much as possible each day; he should outline all the work to be done on the division, and see that the work is properly done. He should be the judge as to how many laborers should be employed in order to keep the track up to the condition required by his superior officers.

When the traffic conditions permit, the roadmaster should be furnished with a motor car. This should be operated under train orders or by proper understanding with the train dispatcher, in order to provide against accidents.

The regular sections should be of moderate length, taking into account the condition of roadbed, the traffic conditions, number of switches, and the length of additional tracks and sidings. Where the conditions warrant sections of exceptional length, they should be furnished with some motive power to take the men to and from work.

Section foremen should be paid a competent salary, in order to secure good foremen. In the past few years it has been demonstrated, that railroad companies are not getting value received for the money expended for section laborers, for the reason that a poor class of laborers is all that can be had for the small wages.

Foremen of extra gangs should be picked from among the best section foremen on the division. All gangs over 25 men should have an assistant for every 25 men over this number, with a time-keeper. One foreman should never be in charge of more than 75 men.

A roadmaster should be allowed full latitude as to the way of doing work on his division; he may be instructed as to what there is to do, but the way to do it should be left for him to decide.

The discussion related largely to the number of men per mile and the number of miles per section on different railways. These features cannot be determined arbitrarily, but must depend upon various local conditions. Most of the speakers favored short sections, about four miles on double track or six miles on single track. One member has 10-mile sections, but this was considered too great a length to be cared for properly by the section gang. Mr. Sweeney (C. & E. In. Ry.) has double-track sections three miles long. Mr. Caffrey (A. T. & S. F. Ry) considered that wages for labor are in many cases high for the class of labor employed, but it is hard to obtain men of a better class. In general, however, the track department suffers from poor pay, a poor class of labor and lack of permanent employment. Under such conditions it is hard to build up an efficient force. One member expressed the opinion that extra gangs should be avoided as much as possible, the work being left to the regular section gangs.

WOODEN AND STEEL TIES.

A general discussion on this subject was opened by Mr. J. M. Meade (A. T. & S. F. Ry.) He referred to the reports issued by the government some years ago, giving particulars of the use of metal ties on foreign railways, and he expressed the opinion that some of these were adapted to American railways as strong enough to carry the rolling stock and traffic of these lines. On his road, wooden ties treated by preservative processes are extensively used, and experiments are being made with a foreign practice of using dowels of treated hardwood to receive the spikes. The dowel is threaded and screwed into the tie, and has a hole to receive a screw-spike. This system is to be used on 20 miles of track, the spikes being driven by a portable machine fitted with a gasoline engine. This road has also 8,000 acres of land for a plantation for tie timber. Mr. W. M. Camp ("Railway Review") referred to the tie-plantation experiments of the Pennsylvania R. R., and to the very limited supply available from such plantations. Mr. E. E. R. Tratman (Associate Editor of Engineering News) was of opinion that the demand for tie supply cannot be met by any one source. Wooden ties will continue to be used very largely, but their life will be increased by the use of preservative processes, metal tie-plates and improved rail fastenings. Steel ties will also be used more extensively. Concrete ties may be found satisfactory for sidetracks and yards (thus reducing the maintenance work), but they appear to be too rigid for main track service. As to the suggestion that steel ties cannot be made strong enough to carry American rolling stock, he pointed out that steel ties are in successful use for nearly 100 miles of the Bessemer & Lake Erie Ry., which has extremely heavy engines and trainloads and an extremely heavy traffic.

Mr. Meade suggested that the fact that this railway is owned by the steel company which makes the ties rather discounted the evidence as to the advantages of the latter. It was shown, however, that the strength of the ties has been proved beyond dispute, while other roads are using these ties experimentally. Mr. Layng, Engineer of Track of the Bessemer & Lake Erie Ry., discussed the practical importance of the steel ties in regard to their strength and to the small amount of maintenance work required. A paper was presented by Mr. Camp, describing the steel-tie track of this road, from which we take the following extracts:

STEEL TIES ON THE BESSEMER & LAKE ERIE RY.—The grades are undulating, and double-headers are required for the freight service. Curves of 4° to 6° are frequent, and there are a number of sharper ones. More than 100 miles of the main line is double track.

As for the traffic, the figures for 1907 showed that 6,500,000 tons of iron ore was carried south-bound, 3,000,000 tons of coal north-bound, and about 3,000,000 tons of miscellaneous freight carried both ways, making in all, about 12,500,000 net tons of freight. The gross tonnage, including that of passenger trains, probably exceeded 21,000,000 tons. The standard freight locomotives of the road are of the consolidation type weighing 125 tons (without the tender), other freight locomotives

in service weigh 112 tons. More than 92% of the freight cars are of 100,000-lbs. capacity, regularly overloaded 10 to 20% in the ore traffic. These trains commonly make 25 to 45 miles per hour on down grade, and the speed of the passenger trains is as fast as the curves will permit; 45 or 50 miles per hour regularly, and 60 miles per hour between stations where the curvature is moderate.

Such conditions render track maintenance arduous and expensive. The use of tie-plates is necessary with wooden ties on the sharp curves, to prevent excessive wear and spreading of the gage. In 1900, some steel ties of triangle section were laid, but the cost of maintenance was excessive, and they were lacking in strength as beams.

After investigating the successful use of the I-beam steel tie invented by Mr. C. Buhrer, of the Lake Shore & Michigan Southern Ry., it was decided to make an extensive trial of this. Accordingly 1,200 were laid in October, 1904, and during the next spring 13,057 more. The service of the ties was carefully watched and records of expense for maintenance of surface were kept for comparison with that of wooden ties on the adjoining track.

The result has been that steel ties are now used throughout the main line in the construction of all new second track and sidings, and for tie renewals. In 1906, the number of steel ties laid was 68,521; in 1907, 98,296; and for the year 1908, 71,484 steel ties were provided. This makes a total of 252,558, or enough ties, if used continuously, to lay about 90 miles of track.

The tie (which is now known as the Carnegie steel tie) is 8½ ft. long, 5½ ins. deep; the top face is 4½ ins. wide, the bottom face is 8 ins. wide. The weight 180 lbs. The rail is held on either side by a clip bolted to the top flange of the tie. The standard track construction of this road consists of 100-lb. rails, in 33-ft. lengths, laid on 20 steel ties, ballasted with crushed slag screened to sizes ¾-in. to 2 ins.

Careful records of maintenance expense, particularly on the piece of track (4.4 miles) laid with steel ties in 1904-5, have shown that the expense of maintaining the steel-tie track in line and surface is somewhat less than 75% of that required for track on wooden ties. In this particular instance, the track on steel ties carries the southbound traffic, which is much heavier than that on the adjoining track laid with wooden ties.

An interesting paper on "The Principles of Railway Curves" was read by Mr. F. A. Smith (of the "Roadmaster and Foreman"). This dealt with the character of simple and compound curves, curve easements, and the superelevation on curves. This was followed by a paper on "Railway Maintenance of Way" by Mr. E. E. R. Tratman (Engineering News); some extracts from this paper we shall publish later. The last subject taken up was the committee report on the proper care of track material and tools. This related to the proper methods of piling ties, timber and rails; keeping stocks or rail and joint fastenings and other track material; caring for scrap; and making the necessary reports and requisitions for tools. This was accepted without discussion.

OFFICERS AND ANNUAL MEETING.

The election of officers resulted as follows: President, A. E. Hansen (C. & N. W. Ry.), Green Bay, Wis.; Vice-Presidents, J. Sweeney (C. & E. Ill. Ry) and W. A. Brandt (C. & N. W. Ry.); Secretary and Treasurer, W. E. Emery (P. & U. Ry.), Peoria, Ill. The next meeting will be held at Washington, D. C., in November, 1909.

THE METHOD OF CALCULATING STRESSES FOR THE BLACKWELL'S ISLAND BRIDGE, AS USED IN BOLLER & HODGE'S RECOMPUTATION.

The Blackwell's Island Bridge over the East River at New York City is a "continuous" or statically indeterminate structure, and moreover it is indeterminate in the second degree, since it has two redundant members. The three separate cantilevers which compose the bridge are each stable and rigid in itself, but they are interconnected by rockers which constrain them to deflect together. Thus, loads on any part of the bridge influence all other parts. The amount of this influence depends on the relative stiffness of the several parts. Thus the calculation of stresses must be carried out by aid of the well-known principles of elastic analysis, as applied to framed structures.

The actual computations for a structure by this method are very laborious, involving an enormous number of multiplications of long decimal figures. However, in the recomputation of the bridge recently carried out by Boller & Hodge at the order of the Board of Estimate of New York City, a simplification of the formulas and systematization of the numerical work was devised which secured a notable economy of labor and time. The simplified arrangement of the formulas is credited to Mr. C. W. Hudson, M. Am. Soc. C. E., who was engaged on these computations for Boller & Hodge.

The method was sketched briefly in an appendix to the firm's report on the bridge, but in our reprint of this report, last week, this was omitted for the reason that it properly merits separate consideration. The following statement, based on this appendix explains the method:

The three parts of the bridge, *A*, *B* and *C* (Fig. 1), are separately stable and statically determinate when the rockers at *L* and *R* are cut or disconnected. Their interconnection by the rockers produces certain stresses in the rockers, whose amount depends on how the loading is distributed. If the stress in any member be calculated (1) for the actual loading when the rockers are cut, and (2) for the rocker stress caused by this loading, the sum of the two will give the true stress in the member. Thus to enable the true stresses to be found, the rocker stresses must be known.

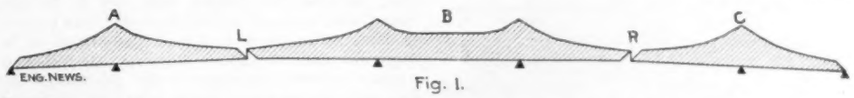


Fig. 1.

The stress in each rocker, or in other words, the force which it must exert on the abutting ends of the bridge parts, is determined by the requirement that the rocker stress must equalize their deflections. If the rockers were cut, for instance, a load on Part *A* would cause the right-hand end of *A* to deflect (either up or down), but would cause no deflection of *B*. The rocker when connected causes *B* to deflect also, at the same time reducing the deflection of *A* in such measure as to make the two deflections equal. To find how great the rocker stress must be to accomplish this effect, it is necessary to compute the deflections which would occur in the absence of the rocker, and the changes produced by a rocker stress of assumed amount, say 1 lb., from which the actual rocker stress can be calculated.

The changes of deflection due to a rocker stress of 1 lb. may be expressed just as well by the deflections produced by a downward load of 1 lb., at the rocker, acting on each of the abutting arms. The latter differ from the former only in algebraic sign, which is readily taken care of in the subsequent computation, and they are more convenient for use. These 1-lb. deflections, six in number, are to be calculated (the rockers being cut) for the conditions indicated by Fig. 2, or in words:

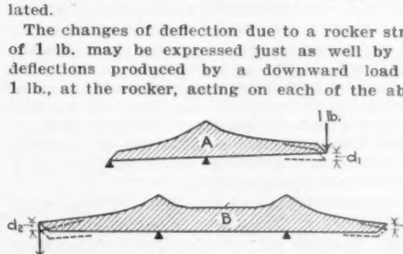


Fig. 2.

d_1 = deflection of Part *A* at *L* under a load of 1 lb. on *A* at *L*.

d_2 = deflection of Part *B* at *L*; d_{30} = deflection of Part *B* at *R* } under a load of 1 lb. on *B* at *L*.

d_3 = deflection of Part *B* at *R*; d_{20} = deflection of Part *B* at *R* } under a load of 1 lb. on *B* at *R*.

d_4 = deflection of Part *C* at *R* under load of 1 lb. on *C* at *R*

Throughout the calculation, all deflections are to be considered positive if downward, negative if upward. The six unit-deflections above listed are all positive. They are readily computed from the known truss outline and known cross-sections of members.

With that loading for which the rocker stresses are to be found, calculate now the four deflections which this load produces at the rocker points (the rockers still being cut) namely:

D_a = the deflection of *A* at point *L*.

D_{bl} = the deflection of *B* at point *L*.

D_{br} = the deflection of *B* at point *R*.

D_c = the deflection of *C* at point *R*.

As above noted, these are to have the plus sign if downward, minus if upward.

The unknown rocker stresses may be called *L* and *R*; they are to be marked positive if they represent tension. They must be of such amounts as to reduce (or increase) D_a and increase (or reduce) D_{bl} to equality, and similarly for D_{br} and D_c. Since one pound acting downward on *A* at *L* produces a deflection downward (positive) of d_1, a rocker tension of *L* lbs. (acting upward on *A*) produces an upward (negative) deflection whose value is Ld_1; since both *L* and d_1 under these conditions are positive, the quantity Ld_1 must be given the minus sign.

In algebraic expression the equality of the resultant deflections of *A* and *B* at *L* appears thus,

$$\left.\begin{matrix}\text{True deflection of } A \text{ at } L \\ = D_a - L\,d_1\end{matrix}\right\} = \left\{\begin{matrix}\text{True Deflection of } B \text{ at } L \\ = D_{bl} + L\,d_2 + R\,d_{20}\end{matrix}\right.$$

Similarly equating the deflections of *B* and *C* at rocker *R*,

$$\left.\begin{matrix}\text{True deflection of } B \text{ at } R) \\ = D_{br} + R\,d_3 + L\,d_{30}\end{matrix}\right\} = \left\{\begin{matrix}\text{True deflection of } C \text{ at R} \\ = D_c - R\,d_4\end{matrix}\right.$$

The first of these equations, solved for *R* in terms of *L* gives

$$R = \frac{D_a - L\,d_1 - L\,d_2 - D_{bl}}{d_{20}}$$

which substituted in the second equation produces

$$D_{br} + (d_3 + d_4)\,\frac{D_a - D_{bl} - L\,(d_1 + d_2)}{d_{20}} + L\,d_{03} = D_c$$

Solving this expression for *L* gives its value, and from it the value of *R* is found by substitution. The two values may be simplified slightly more by noting that $d_{30} = d_{30}$, from Maxwell's reciprocal theorem, so that d_{30} is eliminated by putting in its place d_{20}. The rocker stresses then are:

$$L = \frac{(D_a - D_{bl})(d_3 + d_4) + (D_{br} - D_c)\,d_{20}}{(d_1 + d_2)\,(d_3 + d_4) - d_{20}^2}$$

$$R = \frac{(D_c - D_{br})\,(d_1 + d_2) + (D_{bl} - D_a)\,d_{20}}{(d_1 + d_2)\,(d_3 + d_4) - d_{20}^2}$$

which expressions are symmetrical about the center of the bridge, as the physical conditions require.

In using these equations for computation of rocker stresses for a large number of different load combinations, a great deal of work may be saved by separating the effects due to loads on the three parts *A*, *B* and *C*. In this case the calculation of the rocker stresses is reduced to multiplying a single static deflection by one of three constant coefficients. The latter may be calculated once for all from the drawings of the bridge, in advance of all other work, and do not depend upon the distribution of loads, as will readily appear.

Thus, when only Part *A* is loaded, the rockers being cut, there is no deflection of either *B* or *C*, in other words D_a alone has a value, while $D_{bl} = 0$, $D_{br} = 0$, and $D_c = 0$. Under these conditions the formulas for *L* and *R* reduce to the following simple forms:

For loads on Part A

$$L = D_a\,\frac{d_3 + d_4}{(d_1 + d_2)\,(d_3 + d_4) - d_{20}^2}$$

$$R = -\,D_a\,\frac{d_{20}}{(d_1 + d_2)\,(d_3 + d_4) - d_{20}^2}$$

in which only D_a depends upon the distribution of load being considered.

Similarly, when Part *B* alone is loaded, we observe that D_a and D_c are each zero, so that we obtain from the general formulas the following simplified expressions:

For loads on Part B

$$L = -D_{bl}\frac{d_3+d_4}{(d_1+d_2)(d_3+d_4)-d_{20}^2} + D_{br}\frac{d_{20}}{(d_1+d_2)(d_3+d_4)-d_{20}^2}$$

$$R = D_{bl}\frac{d_{20}}{(d_1+d_2)(d_3+d_4)-d_{20}^2} - D_{br}\frac{d_1+d_2}{(d_1+d_2)(d_3+d_4)-d_{20}^2}$$

And when Part *C* alone is loaded, $D_a = 0$, $D_{bl} = 0$, and $D_{br} = 0$, whence, from the general formulas:

For loads on Part C

$$L = -D_c\frac{d_{20}}{(d_1+d_2)(d_3+d_4)-d_{20}^2}$$

$$R = D_c\frac{d_1+d_2}{(d_1+d_2)(d_3+d_4)-d_{20}^2}$$

If these three sets of equations be inspected closely, it will appear that the coefficients duplicate each other in several instances, and that the eight coefficients really are only three, which may be designated by the letters, *M*, *N* and *G*, thus,

$$M = \frac{d_3+d_4}{(d_1+d_2)(d_3+d_4)-d_{20}^2}$$

$$N = \frac{d_{20}}{(d_1+d_2)(d_3+d_4)-d_{20}^2} = M\frac{d_{20}}{d_3+d_4}$$

$$G = \frac{d_1+d_2}{(d_1+d_2)(d_3+d_4)-d_{20}^2} = M\frac{d_1+d_2}{d_3+d_4}$$

Then the rocker stresses are:

For loads on Part A only:

$$L = M\,D_a$$
$$R = -N\,D_a$$

For loads on Part B only:

$$L = -M\,D_{bl} + N\,D_{br}$$
$$R = N\,D_{bl} - G\,D_{br}$$

For loads on Part C only:

$$L = -N\,D_c$$
$$R = G\,D_c$$

The calculations necessary are, then, as follows: Compute d_1, d_2, d_3, d_4 and d_{20}; from them compute *M*, *N* and *G*, defined as above; next, for any loading on either Part *A*, *B* or *C*, compute the statical deflections D_a, or D_{bl} and D_{br}, or D_c, and multiply by the coefficients *M*, *N* and *G* according to the appropriate pair of the six formulas last given. This gives the rocker stresses separately for the partial loads. For any combination of these loads, the partial rocker stresses are simply added, with due regard, of course, to their signs.

[It may be noted that if the bridge were exactly symmetrical about its middle point, d_3 and d_4 would be equal respectively to d_1 and d_2, and in this case, as the formulas defining *M*, *N* and *G* show, *G* would be equal to *M*. The calculation would, then, be still simpler.]

The tedious part of the calculations is the computation of deflections and rocker-stresses. Generally speaking, this must be done anew for each separate distribution of loading, and when the maximum position for a given member is not known in advance, several positions must be computed. But by proper arrangement of the work there need be only as many deflection computations as there are panel-points.

This was made use of in Boller & Hodge's analysis of the bridge. The procedure was as follows:

Placing a load of 1 lb. at the first panel-point, the statical stresses in the various members were calculated, and from these the statical deflection was computed, and the rocker stresses then obtained by multiplication by *M* and *N*. The rocker stresses enabled the true stress in every member of the bridge to be computed. This process was repeated for the second panel-point, then for the third, and so on for the entire length of bridge. This is in effect a complete calculation for drawing influence lines, but a table of stresses was found very much more convenient than a plotted cluster of influence lines, for the subsequent work. The true stresses being tabulated, from the table it was easy to determine at sight which panel-points required to be loaded to produce maximum stress in any particular member. Then, multiplying the true-stress values, which are for loads of 1 lb., by the respective panel-loads (all the panel-lengths are different) and adding the products, the actual maximum live-load stress in the member resulted.

As noted in the report referred to, the dead-load stresses did not require the use of elastic analysis, because the rockers were not to be adjusted until after the entire dead-load was placed, so that as concerns deal-load the bridge is in three unconnected parts. However, the table of statical stresses obtained in the course of the live-load calculation served also as a ready means of obtaining the dead-load stresses.

A portion of the table of maximum stresses for the greatest load which in the opinion of Boller & Hodge is safe for the structure, was given in our last issue. Elsewhere in the present issue is given the corresponding part of the table of maximum stresses under the specified "congested" loading. Both these tables were computed by the method above described.

CENTRIFUGAL AIR COMPRESSORS.*

In order to successfully meet a demand for moderate pressure air compressors, which was felt to be great, for industrial air-blast and exhauster service, the General Electric Co., of Schenectady, N. Y., has conducted a series of tests for several years on centrifugal compressors. As a result of this work a line of air compressors has recently been placed on the market working with pressure ratings from 0.88 to 4.0 lbs. per sq. in. and in capacities from 750 to 10,000 cu. ft. of free air per minute.

The centrifugal air compressor consists essentially of a rotating impeller surrounded by a suitable casing with an intake opening at the center and a discharge opening at the circumference. In appearance, and in operation it is similar to the familiar centrifugal pump, the efficiency depending largely upon the design of the impeller and casing and on the proper shaping of these parts. These machines are of heavy construction and will operate under adverse conditions with a very low cost of maintenance.

A successful compressing unit of this type necessitated a thoroughly reliable high-speed driver. For this purpose standard turbines have been used in many cases and standard turbo-generators have been utilized as direct-current motors with but slight change. Compressors driven by induction motors are also available. Figs. 1 and 2 show the representative types of turbine and motor-driven compressors. Direct-current motors, as already mentioned, are of construction similar to the generators in turbo-generator sets. Commutating poles and shrunk-ring commutators are used so that sparkless commutating is insured. Each direct-current motor is furnished with a suitable rheostat, so that adjustment of pressure can be obtained by changing the speed. The turbines used for compressing units are of the Curtis type, in all cases similar to those now being manufactured for use with generators. Under the same conditions of service, the steam consumption compares favorably with that of the best reciprocating engines. Slight speed variations can be readily made so that changes in pressure are easily obtained. Turbine-driven sets can be furnished for non-condensing operation and sets above 50 H.P. can be furnished to operate condensing, if desired. These turbines are adapted for steam pressures from 100 to 175 lbs. The induction motors, when used for compressor driving, are furnished with the "squirrel-cage" rotor. Since the speed of this type of motor cannot be varied, care must be taken to specify a pressure sufficiently high to cover the operating requirements, because at constant speed the pressure cannot be varied without altering the design of the impeller.

All these compressors should be furnished with a blast gate located in the discharge main. This gate consists of a simple butterfly valve which prevents the compressor from becoming loaded during the starting period. It also cuts off the discharge main from the opening through the compressor shell to the atmosphere when the shell is not in use.

As in the case of centrifugal pumps, the pressure depends on the peripheral velocity of the impeller. Increased pressure can be obtained by increasing the speed. The volume of free air delivered is limited, however, by the capacity of the driver, and hence must be reduced proportionately to the increase in pressure, otherwise the driver might become overloaded.

The pressure in the mains leading from the compressor is entirely free from pulsation and practically constant for all volumes within the rated capacity of the compressor. Contrary to the results obtained, in the studies of this company, with positive-pressure blowers, the power required to drive centrifugal compressors varies approximately with the volume of air delivered when operating at a constant speed. This gives a greater flexibility and improved economy to the centrifugal type where variable loads are required, satisfactory efficiency being obtained between the limits of 25% and 125% of the rated load.

For foundry cupola service the direct-current motors can be compound wound so as to automatically increase the speed should the volume of air delivered decrease, thus increasing the pressure of the air and preventing undue reduction of flow of air through the cupola when it chokes up. Further adjustments of pressure can be made by changing the speed of the motor by means of the field rheostat. Similar results are obtained for the turbine-driven sets by means of a compensating governor. This feature is not required in all foundries, though it is considered essential in some.

For much blast furnace service this type of compressor bids fair to supplant the reciprocating blow engine, according to the claims of the makers. Any type of reciprocating engine is more or less delicate and requires enough attention and care to result in a very large maintenance expense each year. To keep the blowing engine at its most efficient operating point, it is

*From information and data furnished by the General Electric Co., Schenectady, N. Y.

STANDARD SIZES SINGLE STAGE CENTRIFUGAL AIR COMPRESSORS

Rated pressure, lbs. per sq. in.	Nominal Capacity, cu. ft. free air per min.	Diam. Nominal of discharge pipe, ins.	H.P. driver.	Approximate dimensions of sets with various drivers—Direct-current motors—length, ft. ins.	width, ft. ins.	height, ft. ins.	Induction motors—Approx. dimensions in ft. and ins. length, ft. ins.	width, ft ins.	height, ft. ins.	Curtis steam turbine—Approx. dimensions in ft. and ins. length, ft. ins.	width, ft. ins.	height, ft. ins.
Foundry, cupola or low pressure:												
0.88	2,000	12	20	5 2	3 4	3 11	3 0	3 1	3 11	4 11	3 4	5 11
0.88	3,000	16	30	5 6	3 11	4 7	5 0	3 11	4 7	5 1	3 11	4 7
0.88	7,000	20	50	6 0	4 4	5 5	5 0	4 4	5 4	6 6	4 4	5 5
0.88	10,000	28	75	8 6	6 0	5 8	7 4	6 0	5 8	7 6	6 0	5 8
Moderate pressure:												
2	750	8	11	4 9	4 0	3 11	3 7	4 0	3 11	4 4	4 0	3 11
2	1,500	16	20	4 10	4 5	4 3	2 8	4 5	4 3	4 7	4 5	4 3
2	2,400	12	30	5 0	5 0	5 2	4 8	5 0	5 2	4 8	5 0	5 2
2	4,200	16	50	6 8	5 3	5 5	6 0	5 3	5 5	6 4	5 3	5 5
High pressure:												
3.25	1,300	8	30	4 9	4 9	4 7	4 4	4 9	4 7	4 6	4 9	4 7
3.25	2,400	12	50	6 3	5 2	5 0	5 6	5 2	5 0	5 6	5 2	5 0
3.25	4,400	14	75	7 2	5 4	5 7	6 0	5 4	5 7	6 0	5 3	5 7

usually necessary to overhaul and clean it at least once a year. If this is not done the efficiency decreases very rapidly. The cost of buildings and foundations is a large item to be considered when selecting a blowing unit, because the blowing engine inherently requires considerably more floor space than the centrifugal unit. At least three of these centrifugal compressor sets could be installed in the space required for one reciprocating blowing engine.

For smelters these units have been recommended and for pulp mills and chemical works where a small degree of vacuum is required, they have been claimed as adapted for exhausters.

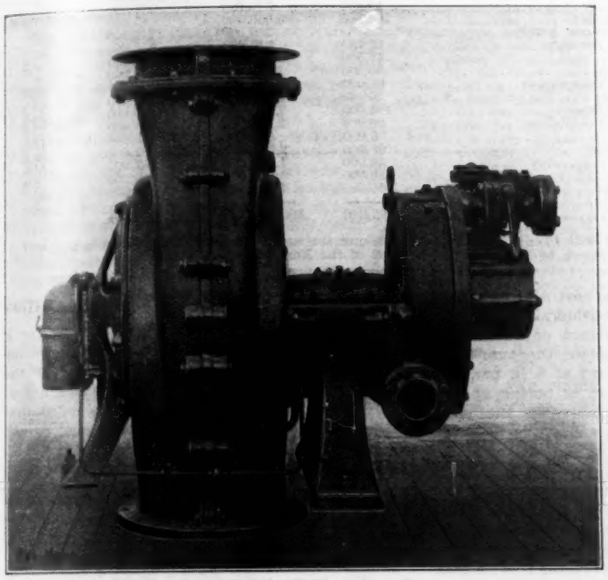


FIG. 1. STEAM-TURBINE DRIVEN.

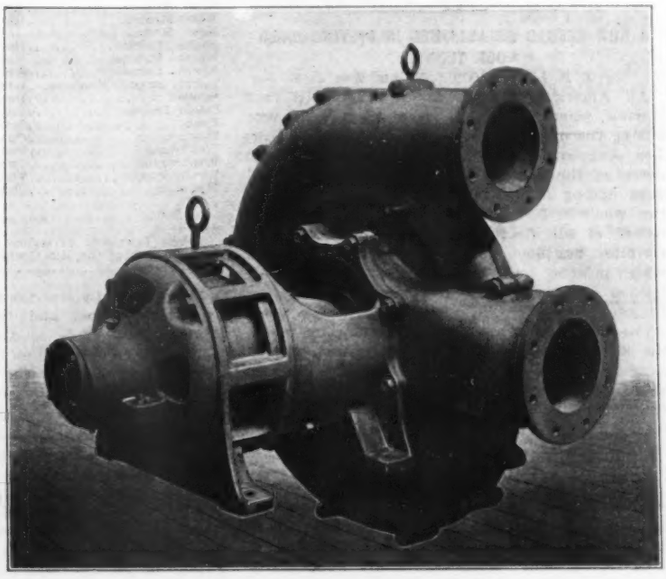


FIG. 2. ELECTRIC-MOTOR DRIVEN.

FIGS. 1 AND 2. CENTRIFUGAL AIR COMPRESSORS; GENERAL ELECTRIC CO., SCHENECTADY, N. Y.

Since the pressure developed is practically constant from no load to 25% overload, as is shown in Fig. 3, these compressors are well adapted for constant-pressure work as in gas or oil-furnace service. For this service one large compressor may be installed in a central location with distribution mains running to the different furnaces, such an installation being preferred to one in which a number of small blowers are located in various places. For ordinary gas or oil furnaces a rated pressure of 1.7 lbs. should be sufficient, although for furnaces requiring a concentrated or positively directed jet 2.7 lbs. rated pressure may be desirable.

Many advantages are claimed for these centrifugal compressor units on account of their simplicity. The only wearing parts are the bearings, and there is neither gearing nor belting. A great advantage is also claimed where a variable volume is required at constant pressure, as this is a characteristic which is inherent in a centrifugal compressor without change of speed or appreciable loss in efficiency. In the displacement type of compressor at constant speed, however, the pressure drops rapidly with the output above a certain point and the volume is limited by the size of the cylinder and the speed. Where pressure fluctuation, due to periodic opening of compressor valves, is objectionable a storage tank is required, involving a cumbersome and expensive arrangement, which is done away with where the centrifugal blower can be used.

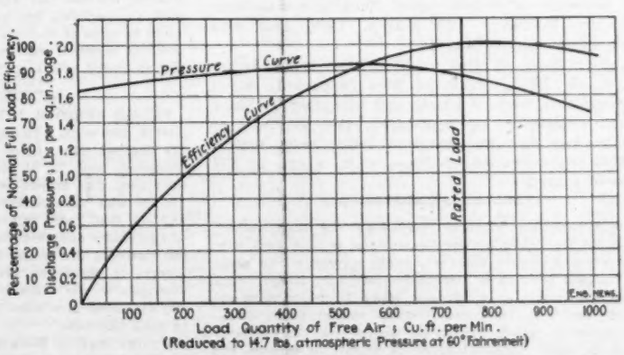

Percentage of Normal Full Load Efficiency
Discharge Pressure; Lbs. per Sq. in. Gage
Pressure Curve
Efficiency Curve
Rated Load
Load Quantity of Free Air ; Cu. ft. per Min.
(Reduced to 14.7 lbs. atmospheric Pressure at 60° Fahrenheit)
ENG. NEWS.

FIG. 3. LOAD CHARACTERISTICS OF A CENTRIFUGAL AIR COMPRESSOR.

DANGER TO FIREMEN FROM PLAYING FIRE STREAMS ON LIVE WIRES.

At a meeting of about 200 officials and employees of the Pensylvania R. R. held at Altoona, Pa., Aug. 17, instructions and demonstrations were given in the methods of handling live wires, in the precautions necessary, methods of resuscitation, and in addition studies were made of the risk of shock to firemen playing streams of water on live wires. Mr. R. H. Newbern, Superintendent Insurance Department, has contributed an account of this meeting to the October quarterly of the National Fire Protection Association. The following extracts from Mr. Newbern's article show the results of the tests with streams:

By reason of the increasing use of electricity along the lines of the Pennsylvania Railroad Co., it has become of great importance that employees have a better understanding of the personal hazard involved in the handling of live wires so that the rescue and resuscitation of those suffering or who have suffered electric shock may not be delayed through ignorance or misconception.

In order to determine definitely what hazard, if any, existed for firemen when they were compelled in line of duty to play water from fire streams on live wires at various potentials, arrangements were made so that circuits of 525, 2,300 and 4,600 volts, respectively, were available. The 525-volt line was a direct current trolley wire connected to the trolley of the Altoona & Logan Valley Electric Railway Co. The 2,300-volt and 4,600-volt lines were fed from alternating current generators at the Altoona car shops. One side of each of these circuits was thoroughly grounded and the fire stream played on the other side which was suspended in the air and thoroughly insulated. A suitable voltmeter was connected between the nozzle and ground to enable the difference of potential between the nozzle and ground to be noted in each case. The following results were obtained, at the voltages specified below, in tests made the day previous to the general demonstration:

525-Volt Trolley Wire—⅝-in. Nozzle:

Distance of nozzle from wire.	Potential between nozzle and ground.
7 ft. 5 ins.	20 volts.
4 ft. 9 ins.	38 volts.
3 ft. 7½ ins.	60 volts.
2 ft. 2 ins.	70 volts.
0 ft. 7½ ins.	210 volts.

These results show that the nozzle may be handled without discomfort up to a point between three and four feet from the wire when those holding the nozzle are standing on the ground. It may be carried much nearer without harm but would probably cause some discomfort. If those holding the nozzle were standing on a ladder or were otherwise insulated from the ground it would be quite safe to bring the nozzle to within a few inches of the wire.

2,050-Volt Line—⅝-in. Nozzle:

Distance of nozzle from wire.	Potential between nozzle and ground.
6 ft. 6½ ins.	static.
3 ft. 5½ ins.	static.

4,100-Volt Line—⅝-in. Nozzle:

Distance of nozzle from wire.	Potential between nozzle and ground.
6 ft. 6½ ins.	static.
3 ft. 5½ ins.	static.

In each of the above tests no measurable deflection could be obtained on the voltmeter but upon touching the nozzle with the hand when standing on the ground a slight effect due to static electricity was noted. All the above results were obtained in tests conducted the day previous to the general demonstration. In the demonstration, however, results were obtained which agreed with these. These results follow:

525-Volt Trolley Wire—⅝-in. Nozzle:

Distance of Nozzle from wire,	Slight indication to hand at nozzle.
3 ft. 0 in.	

2,300-Volt Wire—1-in. Nozzle:

Distance of Nozzle from wire.	Slight indication of static electricity to hand.
8 ft. 0 in.	

4,600-Volt Wire—1-in. Nozzle:

Distance of Nozzle from wire.	Slight indication of static electricity to hand.
10 ft. 0 in.	

In each case the nozzle was sufficiently near the wire so as to cause a solid stream to play on the latter. Just how far the results of a fire hose test with salt water will differ from those above, which were made with fresh water, cannot be said at the present time.

Experiments were also made with streams from hand chemical extinguishers and it was found that when a solid stream is played on a high potential wire it becomes a source of danger to one holding the extinguisher. For instance, the nozzle of an extinguisher was held at a distance of 9 ins. on a grounded 2,050-volt alternating-current line. The difference of potential between nozzle and ground was 1,500 volts when the extinguisher was insulated from the ground.

While the excessive potential existing between the nozzle of the hose attached to the chemical extinguisher may be partly due to the increased

conductivity of the solution constituting the stream as compared with ordinary water, yet it must be largely due to the absence of the stream electrically connecting the nozzle with the ground. The danger would be removed if the extinguisher were well grounded. The use of salt-water fire streams should not be more hazardous than fresh-water. The presence of many salt-water streams playing through high potential wires might, however, be expected to cause trouble to the electrical apparatus supplying these wires on account of the ground connection of the streams and the short-circuit current.

A NEW RECORD ESTABLISHED IN DRIVING HARD ROCK TUNNELS.

By J. B. LIPPINCOTT,* M. Am. Soc. C. E.

All American records for driving hard rock tunnels where drilling is required were broken during the month of October by the forces of the Los Angeles aqueduct at work on the south portal of the Elizabeth Lake tunnel. For the 31 days ending at midnight, Oct. 31, the distance run was 466 ft. Until this time, the American record of 449 ft. for tunnel boring of this description has been held by the Gunnison tunnel which is being built by the United States Reclamation Service for the Uncompahgre irrigation project.

The Elizabeth tunnel is the opening by which the waters of the Los Angeles aqueduct will be carried through the crest of the Coast Range. The tunnel is to be 27,215 ft. long, of which 355 ft. is in open cut, giving 26,860 ft. from portal to portal, and is approximately 60 miles north of Los Angeles. The portal is 24 miles from a railroad.

The distance of 449 ft. on the Gunnison tunnel was accomplished in January, 1908. The work was done by day labor under the bonus system. This tunnel much resembles the Elizabeth in size of cross-section and length. Both are about 12 × 12 ft. in section and the Gunnison tunnel is 30,000 ft. long. Both tunnels are in granite rock. The run of 449 ft. in the Gunnison, however, was made by driving the section one-half size, that is by a smaller heading 8 × 12 ft.

Other tunneling records as published in the Mining and Scientific Press of June 6, 1908, are as tabulated below:†

It is interesting to note that the Elizabeth tunnel and the Gunnison tunnel were driven by day labor under the direct charge of engineers of the government and of the municipality. The Elizabeth tunnel was driven full size by the lower heading method with Model 6-A Water Leyner rock drills. The mucking was done by hand and transported by electric motors. The face, Oct. 31, was 2,508 ft. from the portal.

The work is under the immediate charge of Mr. W. C. Aston, Tunnel Superintendent, who came to the aqueduct from Colorado, where his superintendency of the Joker tunnel attracted attention both for progress and low cost of construction. Mr. Aston is assisted by Mr. J. W. Henderson as Master Mechanic. Wm. Mulholland is Chief Engineer and the writer is Assistant Chief Engineer.

The base rate in the bonus system employed is 8 ft. per day, or 248 ft. for a 31-day month. For each foot in excess of this amount each man working in the tunnel continuously during the month is paid 40 cts. As the cost per day for driving the tunnel is practically a fixed amount, the faster the work is driven the less the cost per foot becomes. The saving to the city in fast work is shared with the men by this means.

The cost per foot of driving the Elizabeth tunnel is materially less than the cost of driving the Gunnison tunnel and is considerably beneath the estimate made by the Board of Consulting Engineers. The rate to complete the tunnel in five years was set by the Board at 8 ft. per day from each portal and the cost of boring at approximately $66 per foot. Including the payment of the bonus the month's run was made at a cost of $35.81 per foot and at the rate of 15 ft. per day.

In this connection it may be stated that 2,819 ft. of tunnel in hard and soft rock in the Jawbone division of the aqueduct have been driven at a cost of $11 per foot, whereas the lowest bid submitted for the work was more than twice this amount. The construction on this division is also in the hands of city forces.

The run of 466 ft. was made with modern tunnel equipment consisting of two 520 cu. ft. Franklin two-stage air compressors, each belt driven by a 100-HP., 440-volt A. C. induction motor which supplies air for the rock drills, etc., etc.; one Fairbanks-Morse 100-KW. motor-generator set, supplying direct current at 220 volts for operation of one six-ton electric locomotive, used in tunnel traction, and one No. 7 Root blower. This equipment is duplicated at the north portal.

The power is supplied from the Castiac substation of the Edison Co.'s Kern River transmission line and is carried to the tunnel over a single pole line of No. 4 bare copper wire under a pressure of 30,000 volts. This line was built during February and March, 1908, and was placed in service May 1.

Operations at the south portal were begun Oct. 15, 1907. Progress was necessarily slow, owing to a lack of power and machinery. Since the installation of equipment, the set rate of 8 ft. per day has been exceeded each month with the exception of June, when a run of 237 ft. was made.

*Assistant Chief Engineer, Los Angeles Aqueduct, Los Angeles, Cal.

†A fuller list of fast tunnel records was published in Engineering News of April 2, 1908, p. 377.

ROCK TUNNELING RECORDS IN THE UNITED STATES.

Name.	Place.	Date.	Maximum progress of a single heading, ft. per month.	Method of Drilling. Machine.	Remarks.
Hoosac	Mass	1865-1873	184	.....	
Sutro	Nevada	1869-1877	417	Machine.	
Nesquehoning	Penn.	1871	165	.....	(Northern Pacifice R. R.
Stampede	Wash.	1897-1900	301	Machine.	(Bunker Hill and Sullivan Mine.)
Kellogg	Idaho	1898	354	Pneumatic	
Raton	Colo.	1907	412	Augers.	(A. T. & S. F. Ry.)
Gunnison	Colo.	1908	449	Machine.	

A MONORAIL STREET RAILWAY has been authorized by the Public Service Commission of New York City for construction in place of an old horse-car line about 3 mi. long between Bartow Station and City Island. This line was bought by a company which is preparing to exploit the Tunis monorail system, an experimental installation of which was at the Jamestown (Va.) exposition in 1907. Application for a permit to convert the line was made some months ago, and now, on a favorable engineering report, the application has been granted by the Commission. Mr. Bion L. Burrows is president of the company.

PROJECTS OF THE U. S. RECLAMATION SERVICE.

Location.	Project.	Area, acres.	Estimated cost.	Estimated Expenditure to Oct. 31, 1908.	Per cent of completion.
Arizona	Salt River	240,000	$7,900,000	$5,850,000	61.6
Arizona-California	Yuma	92,150	5,630,000	2,875,000	51.1
California	Orland	30,000	1,500,000	168,000	11.2
California-Oregon	Klamath	165,000	5,950,000	1,693,000	28.5
Colorado	Grand Valley	50,000	2,500,000	50,000	2
Colorado	Uncompahgre	146,000	5,500,000	3,515,000	64
Idaho	Minidoka (Gravity)	84,200	1,780,800	1,780,800	100
Idaho	Minidoka (Pumping)	49,900	600,000	211,000	35.2
Idaho	Payette-Boise, So. Side Division	132,000	4,765,000	2,250,000	47.2
Kansas	Garden City	10,656	355,000	355,000	100
Montana	Lower Milk River	160,000	6,250,000	250,000	4
Montana	Huntley	33,000	840,000	840,000	100
Montana	Sun River, Fort Shaw Unit	16,000	480,000	480,000	100
Nebraska-Wyoming	North Platte	96,000	4,200,000	3,940,000	93.3
Nevada	Truckee-Carson	100,000	4,390,000	3,951,000	90
New Mexico	Carlsbad	20,000	640,000	640,000	100
New Mexico	Hondo	10,000	370,000	370,000	100
New Mexico	Rio Grande	160,000	8,000,000	65,000	.8
New Mexico	Leasburg Unit*	.....	210,000	210,000	100
North Dakota	Buford-Trenton	12,500	316,000	316,000	100
North Dakota	Nesson	18,500	740,000	18,000	4.5
North Dakota	Williston	12,000	474,000	474,000	100
North Dakota-Montana	Lower Yellowstone	66,000	2,75[illegible],300	2,570,000	82.5
Oregon	Umatilla	20,440	1,208,400	1,065,000	82
South Dakota	Belle Fourche	100,000	3,400,000	2,000,000	58.8
Utah	Strawberry Valley	60,000	2,880,000	630,000	21.9
Washington	Okanogan	9,000	585,000	455,000	77.8
Washington	Sunnyside	99,000	2,253,000	881,000	39.1
Washington	Tieton	30,000	1,800,000	987,000	54.8
Washington	Wapato	120,000	3,000,000	19,000	5.6
Wyoming	Shoshone	150,000	7,560,000	3,175,000	42
Total		2,292,346	$89,431,300	$42,083,800	

*The Leasburg diversion dam will furnish a temporary, intermittent supply to about 20,000 acres, which will be a portion of the Rio Grande Project, and share in the benefits of the Engle Dam.

A SUMMARY OF WORK OF THE U. S. RECLAMATION SERVICE.

We take from the "Reclamation Record" for November the accompanying summary of the work which the Reclamation Service has undertaken since its inception. It will be noted that nine of the projects have been completed or will be by the end of the current year.

A LARGE OIL STILL EXPLODED in the yards of the Tidewater Oil Co., at Bayonne, N. J., Nov. 10. One man was killed and three others injured.

TWO BOILER EXPLOSIONS occurred in lumber mills Nov. 13. At the Millen Lumber Co., near Pound Gap, Ky., four men were killed and as many others injured. The second accident took place at a sawmill in Wise Co., Va. Three men were killed and four injured.

A POWDER MILL EXPLOSION at the Excelsior Powder Co., of Dodson, Mo., Nov. 12, wrecked the glazing room and instantly killed the only employee in that part of the mill. A passenger train was standing on the tracks of the Kansas City Southern Ry. beside the factory, and several coach windows were broken, 35 passengers being slightly injured.

A GRAIN DUST EXPLOSION occurred Nov. 14 in the oat rooms of the main building of the American Milling Co.'s stock food factory, at Linden, Ind. The building at once caught fire and the entire factory was burned. Four men were badly injured. The force of the explosion wrecked the fire-fighting apparatus of the mill and, as the town has no adequate fire protection, little could be done to stop the flames. The room in which the accident occurred was that in which the grain was being manufactured into a special food product.

THREE SERIOUS MINE ACCIDENTS have been reported this week. The most serious was the explosion in the Radbod mine, three miles from Hamm, Westphalia, Germany, Nov. 12, at about 4 a. m. At the time of the explosion, 380 miners were working underground. Of the 72 who were brought to the surface, 37 were dead and the rest badly injured. The explosion wrecked one of the shafts and this, together with the rapid spread of the resulting fire in the mine, delayed the rescue parties. Efforts to check the fire were unsuccessful and in the afternoon it was decided that further efforts to save the 300 entombed men were useless and an order was issued to flood the mine.

A mine cage at Ellsworth Mine No. 1, in Washington Co., Pa., dropped a distance of 285 ft. to the bottom of the shaft, Nov. 16. There were ten men in the cage, six of whom were killed and one seriously injured.

An explosion of gas Nov. 10 at No. 20 colliery of the Lehigh & Wilkes-Barre Coal Co., near Wilkes-Barre, Pa., injured five men, three of whom are not expected to live.

THE PRODUCTION OF PLATINUM from domestic ores in 1907 is given in a summary of the mineral production of the United States, published by the U. S. Geological Survey, as 357 oz., valued at $10,589, as compared with 1,439 oz., valued at $45,189, in 1906. The average price per oz. in 1907 was $29.66, a decrease of about $1.50 from that of 1906.

RAILWAY ACCIDENTS during the second week of November have been unusually numerous and severe. In the accidents reported occurring on Nov. 9 to 13, a total of 37 people have been killed and 75 injured.

A New Orleans Great Northern R. R. express train struck the rear of a local passenger train on the New Orleans & Northeastern R. R. at Little Woods, twelve miles north of New Orleans, La., Nov. 11. Every car of the local was derailed and four coaches were telescoped, killing eight passengers and injuring about 20 others. A coroner's jury brought in a verdict Nov. 14 placing the blame upon the engineer and conductor of the express train, who are said to have disregarded a warning given by a bridge tender that the local was just ahead of them.

A collision between two freight trains on the Union Pacific R. R. at Borie, Wyo., Nov. 10, wrecked 31 cars and killed six trainmen and three Japanese laborers. Three others were seriously injured. One of the trains had gotten beyond control of its brakes on a long down grade and was said to be running 70 mi. per hr. when the collision occurred. The wreckage caught fire, completing the destruction of the cars.

A head-on collision occurred on the Wabash R. R., between a switch engine and a "double-headed" fast freight, at Iles Junction, a few miles south of Springfield, Ill., Nov. 13. Two trainmen were killed and one fatally injured. An investigation will be made by the Railroad and Warehouse Commission, it being claimed that the accident was due to a violation of the state statute regarding railway crossings.

A work train struck the rear of a stalled freight train on the New York, New Haven & Hartford R. R. at Deep River, Conn., Nov. 10. A sharp curve prevented the engineer of the work train from seeing the train ahead in time to prevent a collision and it is claimed that the flagman sent back from the freight was too near it to be of any use. The caboose and the two rear cars of the freight were telescoped. Two men were killed and 24 injured.

The boiler of the locomotive of a fast freight on the Delaware & Hudson Ry. exploded Nov. 13 about half a mile south of East Windsor, N. Y. The brakeman was killed and the fireman fatally injured.

A freight train on the Boston & Albany R. R. struck a string of loaded cattle cars left standing on the main line in Cambridge, Mass., Nov. 10. One man was killed and two others injured. The accident occurred early in the morning during a heavy fog.

The "20th Century Limited" of the New York Central Lines was partially derailed Nov. 12 two miles east of the station at Rochester, N. Y. The accident is ascribed to a broken rail. The train had attained a speed of about 25 mi. per hr. after leaving the station when it struck the rail. The first three of the six Pullman coaches passed over it safely, but the fourth left the track and was followed by the two behind it. The train was quickly brought to a stop and none of the cars overturned.

A trolley car of the Third and Dock St. line in Philadelphia became unmanageable on a hill and collided with a Darby subway car locked in a safety block at the 73d St. crossing. Both cars were wrecked and 16 people injured, two fatally.

A head-on collision took place between two trolley cars on the line of the Public Service Ry. Co., between Boundbrook and Somerville, N. J., Nov. 11. One motorman was killed and six persons injured. The accident occurred on a hill where there is a single track. The road is equipped with a system of signal lights at the switches which are turned on by the motorman as he passes the switch. The motorman of one car and the conductor of the other both claim to have found clear signals at the last switch passed and to have turned on the danger signal.

GALVANIZING STEEL BEAMS FOR FOUNDATION grillages has been tried experimentally at the works of Milliken Bros. It was desired to devise a highly reliable protection against corrosion, because grillage beams are concealed from examination, are situated in a region where water is present, and are fundamental to the integrity of the structure resting on them. It was found to be perfectly practicable to galvanize such beams by the hot process after all shop work on them had been done. In fact, it was possible to galvanize an entire riveted steel column; a very large bath was used, of course. Concrete was found to adhere satisfactorily in respect to lying close against the metal without production of voids. As Mr. Foster Milliken, Assistant to the Receivers of the firm, writes:

> Concrete will adhere to galvanized steel beams as firmly as to unpainted beams which are largely used for grillage work and much better than to unpainted beams.
>
> Experimental grillages were made of the several kinds of beam and surrounded with concrete. Placed in the ground for six months and then broken open they showed perfectly close and firm contact in the case of the galvanized and unpainted beams. The efficiency of galvanized ashlar-anchors and galvanized pipes in concrete is also referred to as demonstrating the adhesion between concrete and galvanized metal. That the zinc coating does prove highly protective against corrosion is a matter of common knowledge. The firm is now prepared to furnish galvanized grillage beams or indeed galvanized structural work generally, as may be required.

PRIZES FOR SENIOR THESES on the design of an electric railway car for city service are offered by the J. G. Brill Co., of Philadelphia, to students of technical schools in the United States who will graduate in 1909. The following particulars are given in a circular announcing the offer:

> The authors of the three theses which in the estimation of a jury shall be considered most meritorious of those submitted, shall receive respectively in order of merit of their work
>
> 1. The sum of $250.
> 2. The sum of $150.
> 3. The sum of $100.
>
> The subject may be considered from any standpoint the student may elect or from all, i. e., from the standpoint of the construction of the car body, the standpoint of the truck, the standpoint of the electrical equipment and its arrangement, etc.
>
> Each thesis will be judged:
>
> 1. On its technical merit.
> 2. On the manner in which the subject is presented.
>
> A jury of three whose decision shall determine the winners of the respective prizes will be appointed to consider the relative merits of the theses submitted. The jury will include an electric railway official of prominence who is thoroughly conversant with the features and requirements of electric railway car construction; a member of the editorial staff of one of the technical journals in the electric railway field; an expert in car construction.
>
> A thesis to be eligible for any one of the prizes need not be prepared especially for this contest. It may be the same thesis which is submitted in connection with senior graduating work; but it shall be the work of a student during his senior year and shall conform to the requirements of the competition.
>
> All theses, to be considered, must be in the hands of the J. G. Brill Co. on or before June 15, 1909.

A LAKE-FRONT HARBOR PROJECT FOR CHICAGO has been submitted to the mayor by a company which proposes to apply to the legislature for the power to carry out the work as a private enterprise. It is provided that the docks would become the property of the city after 20 years of operation. The water front would extend north from the mouth of the river to Indiana St., 950 ft., the riparian rights of which are owned by the Furniture Exhibition Co.; this company has a large warehouse at that point and is backing the new project. Three piers would extend out into the lake; and would be separated by two slips 200 ft. wide. The pier fronting on the river would be 150 ft. wide, and the others 200 ft. wide. The harbor would be protected by the government breakwater on the north (extending from Huron St.) and by an additional breakwater, with an entrance from the southeast. The northern pier would be for both freight and passenger service, having an upper floor for passengers, with gangways to the steamer's decks. Plans for the building have been prepared by Mr. C. A. Eckstrom, architect, of Chicago. The total cost is estimated at from $6,000,000 to $8,000,000, and it is claimed that the harbor could be ready for use by January, 1910. The company has already in service a number of steam lighters which run between its lake-front warehouse and points on the river, and a similar service would provide for transferring freight between the new harbor and points on the river. Mr. James A. Pugh is President of the Furniture Exhibition Co. The project is somewhat similar to that of Mr. Telford Burnham, which was described in our issue of June 20, 1907.

WORK ON THE BARGE CANAL OF NEW YORK State during September, 1908, according to the "Barge Canal Bulletin," totaled $874,023, exceeding that done for August by $174,000, although the record for August had exceeded the amount done in any preceding month by over $150,000. The total amount of excavation during September was 1,195,606 cu. yds. and there was also laid 53,268 cu. yds. of concrete. Although there is small basis for comparison between the Panama and New York State canals, mainly on account of differences in personnel, climate, size of work and methods of administration and construction, the State Engineer each month answers adverse criticisms on the progress of his work by comparing the progress figures of the two canals, generally to the advantage of the Barge Canal work. In this last report the following statement is made:

> The total of excavation for September amounts to 1,195,606 cu. yds.—the largest monthly record thus far. This is 79% of the amount excavated at Panama in September, 1907 (the corresponding month from the commencement of that project under American control) which was likewise the best record there up to that time.
>
> During the month there were laid 53,268 cu. yds. of concrete on the several contracts. For purposes of comparing, it becomes interesting to consider what amount of excavated material this would equal. Using the only common basis of comparison—the cost of each at the average prices on the contracts let—this amount of concrete equals nearly a million yards of excavation. In like manner the whole amount of all work done during last month is equivalent to two and a half million yards of excavation. Continuing the comparison with the Panama Canal, we see that, although the summary of excavation on the Isthmus up to Oct. 1, 1907, was 16,825,345 cu. yds., while the total on the Barge Canal to Oct. 1, 1908, equals 12,654,216 cu. yds., the whole of all work done thus far on the Barge project, if considered as excavation, would amount to nearly twenty million cubic yards. It will be recalled that at Panama, even to the present time, little has been done toward the actual construction of the canal except in the way of excavating. Accordingly there can be no fair comparison between these two great engineering schemes that does not take into account all that has been done on each, reducing it to a common unit in some such way as given here. It should be remembered also that at some places large amounts of excavating have been done for which the contractors get no pay, and consequently this additional yardage is not included in the totals shown above.

MORE STEEL PASSENGER CARS have been ordered by the Pennsylvania R. R. Co., the order being divided among the principal car-building companies as follows: Pressed Steel Car Co., 24 70-ft. combination passenger and baggage cars, 4 60-ft. baggage cars and 3 70-ft. baggage and mail cars; American Car & Foundry Co., 23 70-ft. passenger coaches and 6 60-ft. baggage cars; Standard Steel Car Co., 17 70-ft. passenger coaches. The total number of cars ordered is 77. The passenger coaches are each provided with seats for 83 passengers. A number of minor alterations have been made in the design which was used for the 200 steel cars previously ordered by the Pennsylvania R. R. and which was described in Eng. News, June 20, 1907, p. 671. Information sent out by the publicity department of the railroad company states that aside from the mahogany sash and seat frames there is to be no wood whatever in the cars and that out of a gross weight of about 116,000 lbs. for the entire car, the wood in it will weigh only about 300 lbs. A central box girder 24 ins. wide and 19 ins. deep will extend throughout the length of the coach to secure it against the dangers of collision. To further insure the car against collapsing, its frame structure is designed upon the principle of the cantilever bridge with the trucks as piers. A coupler of a new type, said to be stronger than any used before, has been designed for these cars. The floors are of magnesium cement laid on corrugated iron. The coaches will be lighted by electricity derived from train generators or storage batteries.

THE COLORADO RIVER BREAK OF 1905.—For years Mr. Rockwood's efforts to interest capital were fruitless, but he kept on trying, discouraged but not dismayed by repeated failures. In his dreams, he saw a colony of prosperous homes and fertile farms irrigated by the Colorado's waters, rich with its fertile silt, and he named it the Imperial Valley. How many laughed at him and ridiculed his pretentious name, he alone knows. At last, after many disappointments, he formed, with some associates, the California Development Company, and conducted water to the desert in the spring of 1901, and his Imperial Valley sprang from the arid waste under its magic touch. So quickly did settlers come, and so rapidly was land brought into cultivation, that the canal people were at their wits' end to keep up the supply of water. The permanent Hanlon's gate had not been built, only a temporary heading existed, and the canal lacked several feet of being down to the proposed grade. In October, 1904, with more than 90,000 acres of land under cultivation and with 10,000 inhabitants in the valley, the heading of the canal began to silt up, and a water famine was imminent. An open cut was made from the river to the canal 4 miles below Hanlon's, and the world-famous Colorado crevasse resulted. It is not intended to go into the details of this crevasse, but, placed in Mr. Rockwood's position, nine out of ten engineers would have opened this cut just as he did—this is said advisedly, the speaker having an intimate knowledge of all the facts in the case.—W. W. Follett in discussion of "Irrigation," Proc. Am. Soc. C. E., Sept., 1908, p. 1018.

PERSONALS.

Mr. J. D. Harris has been appointed General Superintendent of Motive Power of the Baltimore & Ohio R. R., succeeding Mr. J. E. Muhlfeld, resigned.

Mr. Walter B. Snow, M. Am. Soc. M. E., publicity engineer, of Boston, Mass., has been appointed a member of the Massachusetts Commission for the Blind.

Mr. E. A. Ennis and Mr. E. J. Nelson, formerly with the Mergenthaler Linotype Co., have opened an office as factory systematizers and cost men, at 173 York St., Jersey City, N. J.

Mr. John B. Marston has been elected County Surveyor of Lucas, Co., O. He is 82 years old and was employed as an engineer in the survey of military roads during the Civil War.

Mr. Ellgood C. Lufkin, Vice-President and General Manager of the Snow Steam Pump Works and the Holly Mfg. Co., of Buffalo, N. Y., has resigned to accept a position with the Texas Co., an independent oil company. His resignation is to take effect Jan. 1.

Mr. Richard C. Maclaurin, Professor of Mathematical Physics at Columbia University, has been elected President of the Massachusetts Institute of Technology. He was born in Edinburgh, Scotland, in 1870 and received

the degree of B. A. at the University of Cambridge in 1892, and in 1896 the degree of M. A. Before coming to Columbia University, he had taught for nine years at the University of New Zealand.

Mr. Emil Swensson, M. Am. Soc. C. E., consulting and constructing engineer of Pittsburg, Pa., returned home with his family on the "Kronsprinzessin Cecilie" Nov. 17, after five months spent in European travel. Mr. Swensson was commissioned by the city and Chamber of Commerce of Pittsburg to make special studies of European practice in flood prevention and protection, and he visited Germany, Australia, Sweden, Norway, Denmark and England in this investigation. He also made studies of passenger transportation methods abroad, with especial reference to Pittsburg's problems.

Obituary.

Edgar K. Betts, a trustee of the Rensselaer Polytechnic Institute, died Nov. 15 in Seattle, Wash., at the age of 66 years.

I. Y. Sage, formerly General Superintendent of the Atlanta & Charlotte Air Line and Georgia Pacific Rys., which are now a part of the Southern Ry. system, died Nov. 14 in Atlanta, Ga., from pneumonia.

Henry Gustave Joly de Lotbinière, formerly Lieut.-Governor of British Columbia, died Nov. 16 at his home in Quebec. He was much interested in forestry and was Vice-President of the American Forestry Congress in 1885.

James Ferguson, Superintendent of the Safety Insulated Wire & Cable Co., of Bayonne, N. J., died Nov. 15 at his home in Bayonne of kidney trouble. Mr. Ferguson was born in Nova Scotia in 1860. He was formerly Superintendent of the municipal electric lighting plant in Brooklyn, N. Y.

Edward V. Skinner, Assistant Traffic Manager of the Canadian Pacific Ry., died suddenly Nov. 8 at his home in Yonkers, N. Y. Mr. Skinner was a bridge commissioner of New York City in 1889 and 1891 and was Vice-President of the Brooklyn Bridge Trustees in 1894 and '95. He was born in London, England, in 1849 and was brought to this country when a child.

John A. Cruikshank, Vice-President of the Continental Cement Co., of St. Louis, Mo., died at his home in Waterloo, Iowa, Oct. 29. Mr. Cruikshank was born in Delaware Co., Iowa. Before organizing the Continental Cement Co., he had been successively President of the Union Portland Cement Co., Rushsylvania, Ohio, and Vice-President of the Indian Portland Cement Co., Neodesha, Kan.

Henry W. Hovey, Major, U. S. A. (retired), died suddenly at Northfield, Vt., Nov. 14. Though not an engineer himself, he had a large acquaintance among engineers, largely through his eight years' service as Commandant of Norwich University, the old military and engineering school at Northfield, Vt. He was appointed second lieutenant from New York in 1880 and was retired in 1907. His last field service was in the Philippines.

Richard W. Gorrill, a contractor of Oakland, Cal., died Nov. 9 at Rhyolite, Nev., where he had gone for his health. Mr. Gorrill was born in Ohio in 1848, but about half his life was spent in California. For several years he was President of the Pacific Bridge Co. He erected the Ferry Building in San Francisco and the Modesto and Turlock Irrigation Project dam at La Grange. He retired from the construction business in 1898.

William E. Ayrton, M. I. E. E., died in London, England, Nov. 8. Mr. Ayrton was born in 1847 and educated at University College, London. In 1867 he entered the Indian Government Telegraph Service and from 1873 to '78 was Professor of Natural Philosophy and Telegraphy at the Imperial College of Engineering in Japan. In 1884 he became Professor of Electrical Engineering at the Central Technical College, South Kensington, England, and was made Dean of that institution in 1904. He was President of the Institution of Electrical Engineers in 1892. Mr. Ayrton was the author of a book on "Practical Electricity."

Oliver W. Barnes, M. Am. Soc. C. E., died at his home on 94th St., in New York City, Nov. 14. Mr. Barnes was born at Berlin, Hartford Co., Conn., in 1823. His education was received at the Burlington, N. J., high school and at a private school of engineering in Philadelphia. He also studied in Europe in 1846. In 1847 he was appointed Assistant Engineer in the first corps assembled at Pittsburg on the Pennsylvania R. R. The following year he became Principal Assistant Engineer and made the final location for the line of the Pennsylvania R. R., from the Allegheny Mts. to Pittsburg, remaining in charge of its construction during the next five years. From 1853 to '57 he was Chief Engineer of the Pittsburg & Connellsville R. R. Co., and was afterward connected in a similar capacity with several other railways. In 1892, he became Chief Engineer and President of the New York Connecting R. R. Co. Mr. Barnes is survived by his wife, who is a daughter of Maj. Edward Harding, U. S. A., and three children. His son is Mr. E. H. Barnes, M. Am. Soc. C. E., Chief Engineer of the Grand Rapids & Indiana Ry.

ENGINEERING SOCIETIES.

COMING MEETINGS.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 19-20. Annual meeting at New York City. Secy., W. J. Baxter, 29 West 39th St., New York City.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. 30-Dec. 1. Annual meeting at New York City. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 15-17. Annual convention at Washington, D. C. Secy., Glenn Brown, "The Octagon," Washington, D. C.

NATIONAL ASSOCIATION OF CEMENT USERS.
Jan. 11-16. Annual convention at Cleveland, Ohio. Secy., Geo. C. Wright, Harrison Bldg., Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Jan. 19. Annual meeting at New York City. Secy., W. M. Mackay, P. O. Box 1818, New York City.

SOCIETY OF RAILWAY CLUB SECRETARIES.—An index of papers and subjects discussed by railway clubs from May 31, 1907 to May 31, 1908, has been published by this society.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—More than 400 members took part in a tour of inspection to the Universal Portland Cement Co., at Universal, Pa., Nov. 7.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—At the meeting of the Mining Section, held at Montreal, Nov. 12, Mr. C. L. Cantley presented a paper on "Modern Retort Coke Ovens, with Special Reference to the Practice of the N. S. Steel & Coal Co." A General Section meeting will be held Nov. 19 at Montreal.

APPALACHIAN ENGINEERING ASSOCIATION.—The regular December meeting has been postponed on account of the large number of mining and engineering society meetings to be held in that month. The next meeting will be the annual session in February, at Frostburg, Md.

WESTERN RAILWAY CLUB.—At the November meeting, held at Chicago, Nov. 17, a paper was discussed, entitled "Flat Spots on Car Wheels," by Prof. Chas. H. Benjamin, Dean of the School of Engineering and Director of the Engineering Laboratory of Purdue University.

ENGINEERS' SOCIETY OF MILWAUKEE.—At the meeting held Nov. 11, in Milwaukee, a lecture on "The Close Relation between the Forest Reserves and the Water Powers of Wisconsin," was delivered by Mr. C. M. Griffith, State Forester. After discussing the general subject of forestry and reforestation, Mr. Griffith took up particularly the influence of forests in the regulation of stream flow, storage reservoirs and water powers of Wisconsin. Mr. W. Fay Martin, 456 Broadway, Milwaukee, Wis., is Secretary of this society.

AMERICAN INSTITUTE OF ARCHITECTS.—At the annual convention in Washington, D. C., Dec. 15-17, a committee will present a report on "The Relation of the National Government to Art." It is understood that the committee will recommend the establishment of a Bureau of Fine Arts under one of the Government departments. Formal addresses on the same subject will be delivered by James R. Garfield, Secretary of the Interior; Nicholas Murray Butler, President of Columbia University; Henry M. Prichett, President of the Carnegie Educational Trust, and others.

BROOKLYN ENGINEERS' CLUB.—At the meeting held at 197 Montague St., Brooklyn, Nov. 12, Mr. Lawrence A. Ball, Assoc M. Am. Soc. C. E., presented a paper entitled "The Constructional Features of the St. Paul Auditorium, of St. Paul, Minn." This paper will take up the multiple purposes of the building, the long span roof trusses, the cellular fireproof wall supports, the pivoted boxes, the suspended proscenium wings and the composite concrete and steel balcony construction. There will be a short reference to the method of financing the project. The paper will be illustrated by numerous lantern slides. A general description of the St. Paul Auditorium was published in Eng. News, June 6, 1907, p. 633.

THE AMERICAN RAILWAY ASSOCIATION.—The fall session will be held at the Auditorium Hotel, Chicago, Ill., Nov. 18. Reports will be presented by the following committees: Executive Committee; Committee on Train Rules; Committee on Car Service; Committee on Safety Appliances; Joint Committee on Interlocking and Block Signals; Committee on Accounting and Statistical Inquiry; Committee on Transportation of Explosives; Committee on Standard Location for Third Rail Working Conductors; Committee on Car Efficiency; Committee on Nominations. The election of a First Vice-President, three members of the Committee on Car Service, three members of the Committee on Safety Appliances and two members of the Committee on Nominations will take place at this meeting.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—At the annual meeting in New York City, Dec. 1-4, the following papers will be presented: Dec. 1, "The Conservation Idea as Applied to the American Society of Mechanical Engineers" (presidential address), M. L. Holman. Dec. 2, "The Engineer and the People," Morris L. Cooke; "Aeronautics," Maj. Geo. O. Squier, Acting Chief Signal Officer, U. S. A. Method of Obtaining Ratios of Specific Heat of Vapors," A. R. Dodge; "The Total Heat of Saturated Steam," Harvey N. Davis; "Fuel Economy Tests," C. R. Weymouth; "An Automatic System for Firing Fuel Oil," C. R. Weymouth. Dec. 3, "Efficiency Tests of Milling Machines and Milling Cutters," A. L. Deleeuw; "Metal Cutting Tools Without Clearance," James Hartness; "Interchangeable Involute Gear Tooth Systems," R. E. Flanders; "Durability of Gears in Electric Railway Service," Norman Litchfield; "Industrial Photography," Ashton Read; "Articulated Compound Locomotives," C. J. Mellin; "Liquid Tachometers," Amasa Trobridge; "Training Workmen," H. L. Gantt; "An Averaging Instrument for Polar Diagrams," W. F. Durand; "Salt Manufacture," Geo. B. Wilcox; "Reminiscences of a Gas Engine Designer," L. H. Nash; "Possibilities of the Gasoline Turbine," F. C. Wagner. Dec. 4, "Physical Properties of Carbonic Acid and the Conditions of Its Economic Storage for Transportation," R. T. Stewart; "The Slipping Point of Rolled Boiler Tube Joints," O. P. Hood and G. L. Christensen; "Tests on Friction Clutches for Power Transmission," Richard G. Dukes.

WESTERN SOCIETY OF ENGINEERS.—At the meeting held at the Society's room in Chicago on Nov. 4, a paper on "The Improvement of the Upper Mississippi River" was presented by Col. C. McD. Townsend, Corps of Engineers, U. S. A. The paper dealt with the improvement of that part of the river between St. Paul and St. Louis, about 600 miles. The project was first to obtain a minimum depth of 4½ ft. in the channel at low water, but this has been changed to provide for a depth of 6 ft. The open river work includes bank revetment and wing dams. Two rapids are encountered, one of which is avoided by a canal, while at the other the channel has been improved. Harbors of refuge, ice harbors, breakwaters, levees and other incidental works are required in the general improvement scheme, and their construction was described in the paper.

In opening the discussion, the President, Mr. C. F. Loweth (C., M. & St. P. Ry.), remarked that the engineer in charge of river improvement is at a certain disadvantage, that much of his work lies hidden and unknown to anyone but himself and his associates. Thus the deepening of a channel for navigation may involve very difficult and important work, but shows no visible results.

Major W. V. Judson (Corps of Engineers, U. S. A.) expressed the opinion that river traffic on the Mississippi is decreasing, in spite of the greater channel depth that has been obtained by the improvement works. He thought this condition due to the great economies effected in railway transportation before navigable waterways were commercially available. In Europe, on the other hand, much of the waterway work was done before the days of railways, while in those countries the economies in railway transportation have not been carried out to the same extent as in this country. Consequently, the inland navigation systems are well established and are on a better footing as far as commerce is concerned, than are the similar systems in this country. As far as inland waterways for modern transportation in the United States are concerned, he considered that they were simply on an experimental basis as far as any commercial value is concerned. Great systems of river improvement were projected 50 years ago, but it was shown that they would not be profitable and they were abandoned, and wisely so, in his opinion. With the present system of railways the chance of profitable operation is less, but there is some danger that the lesson will have to be learned over again. He also discussed some features of the reservoirs at the headwaters of the Mississippi, forming the greatest artificial reservoir system in the world.

Col. Townsend stated that the records showed an increase in traffic on the upper Mississippi in the past two years, but thought this due to greater care in collecting statistics rather than to an actual increase. Much of the traffic is lumber, and this is falling off in consequence of the destruction of the forests. There is, however, an increase in the number of small or local steamboat lines. Major T. H. Rees (Corps of Engineers, U. S. A.), spoke as to the reduction in lumber traffic on southern rivers due to forest destruction.

Mr. C. L. Strobel (Chicago) referred to the very slight commercial value of the Hennepin boat canal, built at great expense and completed after many years had been spent in construction. He expressed the opinion that the state governments should help the national government in harbor improvement work, as this is of benefit to the states themselves. Mr. Isham Randolph (Chicago) took up the cudgels in behalf of the waterway system, which seemed to receive considerable discouragement from most of the speakers. A large part of the discussion related to questions of comparative freight rates on rail and water lines.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, November 19, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(* denotes *that this work is advertised in Engineering News.*)

The following plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids. close.	Work.	Place.	See issue.
11-20*	Bridge,	Beaufort, N. C. (P. & S.)	10-29
11-20*	Dredge,	Mobile, Ala.	(P. & S.)10-15
11-20	Boiler,	Fort McIntosh, Tex.	(S.)10-29
11-21	Freight elevators,	Charleston, S. C.	(S.)11- 5
11-21	Air compressors,	Wash., D. C.	(S.)11-5
11-21	Alterations of bldgs.,	Philadelphia, Pa.	(S.)10-22
11-21	Water mains,	Pensacola, Fla.	(S.) 10-29
11-24	Boilers, etc.,	Pekin, Ill.	(P. & S.)11- 5
11-27	Sewage pumping machinery,	Grand Rapids, Mich.	(P. & S.)11-12
11-28*	Railway, dry-dock,	St. Louis, Mo.	(P. & S.)11-29
11-30	Pipe, etc.,	Gridley, Cal.	(S.)11-19
11-30	Aqueduct,	Los Angeles, Cal.	(S.)10-22
12- 1	Dredging,	Hawaii	(S.) 9-17
12- 4*	Earth dam,	Springfield, Mass.	(S.)11-12
12-11*	Bridge,	Green Bay, Wis.	(P. & S.)11-19
12-14*	Steel tank and tower,	Gridley, Cal.	(S.) 11-19

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

11-20 Power-house, Soldiers' Home, Cal.11-12
11-21 Alterations, 'phone system,etc., Philadelphia, Pa.....10-29
11-23 Sale, gas plant, Newburn, N. C.10-29
11-25 Lighting, Johnstown, Pa.....11-12
11-25 Transformer, etc., Columbus, O..11-19
11-30 Elec. supplies, Wash., D. C.....11-19
12- 2 Light and power, New York.....11-19
12- 2 Transmission lines, Ft. Sam Houston, Tex.....11-12
12-11 Power-house, Cincinnati, Ohio..11-19
1- 4 Lighting, Hartford, Conn.....11-12

BRIDGES.

11-20* Bridge, Beaufort, N. C.....10-29
11-20 Bridge, Philadelphia, Pa.....11-19
11-21 Bridge, Pensacola, Fla.....11-19
11-23 Bridge, San Bernardino, Cal.....11-19
11-23 Bridge span, Greenville, S. C.....11-19
11-23 Bridge, Hanover, Va. 11- 5
11-25 Bridge, Monongahela, Pa.....11-12
11-30 Rebuilding bridge, Lepreau, N. B.11-19
11-30 Rebuilding bridge, Havelock, N.B.11-19
12- 2* Superstructure, Evanston, Ill.....11-19
12- 7* Viaduct, Kansas City, Mo.....11-12
12- 7 Bridge, Grenada, Miss.....10-29
12- 8 Bridges, Princeton, Ind. 11-12
12-14* Bridge, Green Bay, Wis.....11-19
12-16 Substructure, etc., Columbus, O.11-12
1-12 Bridge, Rensselaer, Ind.....10-29

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11-20 Post-office, Trinidad, Colo.....10-29
11-20 Quarters, Jefferson Barracks, Mo.11-19
11-21 School, Wilkinsburg, Pa.....11-19
11-21 Bldg. alterations, Phila., Pa. 10-22
11-21 Ice machine, Porto Rico (U. S. Poss.) 11-12
11-21 Tiling, marble, etc., Wash., D. C.11-12
11-23 Infirmary, Chicago, Ill 11- 5
11-24 Plans, Kenosha, Wis.....11-12
11-25 Laundry (Mfg. Pl.), New York.11-12
11-25 Post-office, Hazelton, Pa 11- 5
11-25 School, Hartshorne, Okla.....11-19
11-25 Firehouses, New York.....11-19
11-27 Residence, New York 11-19
11-27 Schools, Philadelphia, Pa.....11-19
11-27 Warehouse, Cincinnati, O.....11- 5
11-27* Post-office, Milford, Del.....10-29
11-30 Post-office, Manchester, Va.....11- 5
11-30 Boiler house, etc., New York...11-19
11-30 Infirmary, New York 11-19
11-30 Court-house, etc., New York....11-19
12- 1 Removing bldgs., New York....11-19
12- 1 Building, Muncie, Ind. 11-12
12- 1* Post-office, Newton, Kan. 10-29
12- 1 Quarters, Ft. Hamilton, N. Y...11-12
12- 1 Building, Wash., D. C. 11-12
12- 2* Post-office, Carlisle, Pa.....10-29
12- 3 Foundations, New York.....11-19
12- 7 Jail, Lebanon, Ind.....11-12
12- 8 Post-office, Gainesville, Ga.....11-12
12- 9 Buildings, Columbus, Ohio.....11-19
12- 9 Flour and sawmill, Jocko, Mont. (Mfg. Pl.) 11-19
12-14* Buildings, Ft. Meade, S. Dak...11-12
12-14 Steel, Madison, Wis.....11-19
12- Exhib. bldgs., Seattle, Wash....11-19
12- Post-office, Coldwater, Mich.....11-19
12- * Post-office, Alexandria, Minn...11-19
12- * Post-office, Americus, Ga.....11-19
12- Post-office, Lake Charles, La....11-19

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11-20 Boiler, Fort McIntosh, Tex.....10-29
11-21* Water system, Wash., D. C.....11-12
11-21 Water mains, Pensacola, Fla....10-29
11-23* Filtration plant, Wilmington, Del.10-15
11-23* Equipment, Pittsburg, Pa.....11- 5
11-23 Water-works impvt., Las Animas, Colo.....11-12
11-23 Water supply, Kingston, Ont....11-19
11-23 Water supply, Chicago, Ill.....11-19
11-23 Cleaning mains, Pittsburg, Pa....11-19
11-24* Pipe and castings, Amsterdam N. Y. 11-19
11-24* Water conduit, Reading, Pa.....11-12
11-24 Boilers, etc., Pekin, Ill. 11- 5
11-24* Pumping engine, Augusta, Ga. ..11- 5
11-24* W.-wks. extensions, Wenatchee, Wash. 10-29
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12- 1* Cast-iron pipe, etc., Greenville, Tex. 11-19
12- 1 Water-works, Wilton, Wis. 11-19
12- 1* Pressure tunnel, New York.....11-12
12- 1* Reservoir, Yorkville, Ill.....11-12
12- 2 Water-works, Covington, Ga.....11-19
12- 4 Drain, Springfield, Mass. ..11-12
12- 8 Reservoir, engine, Meridian, Miss.11-19
12-14* Steel tank and tower, Gridley, Cal. 11-19

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11-21 Sewers, Roanoke, Va.....11-12
11-23 Sewer system, etc., Polk, Pa.....11-12
11-23* Sewage plant, East Rutherford, N. J.....11-12
11-23 Sewers, Akron, Ohio.....11-19
11-24 Sewers, St. Louis, Mo.....11-19
11-24 Sewers, etc., Long Island City, N. Y.....11-12
11-25 Sewers, Brooklyn, N. Y.....11-19
11-25 Sewer, Buffalo, N. Y.....11-19
11-25 Sewers, Aberdeen, Wash. 11-19
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RAILWAYS.

ALBERTA NORTHWESTERN.—We are officially advised that nothing is being done at the present time in regard to construction of this railway. As noted on Oct. 8, this company was recently incorporated with $500,000 capital to build from Edmonton, Alta., to the British Columbia boundary at Peace River, via Athabasca Landing, Lesser Slave Lake and Dunvegan; also from Edmonton to the International boundary via Medicine Hat. The offices of the company will be at Edmonton.

ARKANSAS, LOUISIANA & GULF.—This company now operates 52 miles of railway between Monroe, Bastrop and Wardville, La., Rolfe Junction and Crossett, Ark., and between Rolfe Junction and Hamburg, Ark., nine miles. Plan is under consideration to build an extension from Hamburg to Pine Bluff. James M. Parker is Gen. Mgr., Monroe, La.

BEAVER VALLEY & NORTHWESTERN.—This company is stated to have awarded contracts for building this railroad in Oklahoma from Gage, via Beaver, to Hooker, a distance of 105 miles. Surveys are made. Capital for construction and right-of-way have been obtained. H. A. Perkins is Ch. Engr., Beaver, Okla. J. M. Kerns, Sunset, Okla., is Gen. Mgr. Noted on Sept. 10.

BONLEE & WESTERN.—We are officially informed that this company will do its own grading, and will let no contracts, on the proposed line from Causey to Waddell's Ferry on Deep River, N. C., a distance of 13 miles. Waddell's Ferry is between Ramseur and High Falls, N. C. Surveys are made and right-of-way and capital secured. The incorporation of this company was noted on Oct. 22. I. H. and J. H. Dunlap are the owners, and Reid Tull is Ch. Engr., at Causey, N. C.

CHICAGO, BURLINGTON & QUINCY.—Stockholders on Nov. 4 approved the purchase of the following subsidiary lines: Fulton County Narrow-Gage Ry., Northern & Southern Illinois, Sioux City & Western, and Big Horn Ry., aggregating 304 miles.

CHICAGO, MILWAUKEE & ST. PAUL.—This company, according to the New York "Times" on Nov. 18, probably will merge into one corporation the Chicago, Milwaukee & St. Paul companies of South Dakota, Montana, Idaho and Washington, which are building the St. Paul's extension to the Pacific Coast, and to issue against this new line and its equipment probably $100,000,000 of bonds.

CLINTON, OKLAHOMA & WESTERN.—This company has been organized in Oklahoma, with headquarters at Clinton, Custer County, and a State charter has been granted. The incorporators include C. C. Godman, of Fort Smith, Ark.; T. J. Nance, C. H. Lamb, E. A. Humphrey and J. T. Bradford, all of Clinton. Mr. Godman has promoted several railroads in Arkansas and adjoining States and will be president of the new company. The purpose is to build a road from Clinton west through Butler and Cheyenne, Okla., to Canadian, Tex., thence northwest to Colorado Springs. The preliminary survey for the line has been completed. The new company has a capital stock of $500,000. The proposed route covers a distance of 400 miles. From Clinton westward the survey runs through the Counties of Custer, Roger Mills, Ellis, Woodward, Harper, Beaver, Texas and Cimarron, and across the corner of New Mexico and through Colorado to Colorado Springs. A line is also included in the charter to build eastward from Clinton through the Counties of Washita, Caddo, Grady, Canadian, Cleveland, McClain, Garvin, Pontotoc, Murray, Johnston and Coal, tapping the Oklahoma coal and asphalt fields.

COLORADO, COLUMBUS & MEXICO.—We are officially advised that surveys have been made for this railway. It will extend from Columbus, N. Mex., northwest through New Mexico, and will be about 500 miles long. Right-of-way has not been secured. Date for letting contracts is uncertain as yet. A. O. Bailey is Pres., Columbus, N. Mex. W. P. Halliday is Ch. Engr., Deming, N. Mex.

DENVER, LARAMIE & NORTHWESTERN.—A. E. Welby, Vice-Pres., Denver, has awarded contract for 40,000 tons of steel rails of the standard weight, to be shipped by the COLORADO FUEL & IRON Co. from Pueblo, Colo., as soon as possible to complete the tracklaying on the first 40-mile section of the road. Beyond Hilleboro, which is near the terminus of the first 40-mile section of track, three surveys have been completed through Fort Collins and northward into Wyoming. As noted on Oct. 15, we were advised that ORMAN & CO., Pueblo, Colo., have a 45-mile contract. About 40 miles are completed. Surveys are made for 202 miles and right-of-way secured for greater portion of this distance. This line eventually will run from Denver to Seattle, Wash., via Laramie, Walcott and Lander, Wyo.; St. Anthony, Jones, Salmon and Lewiston, Idaho. Chas. Scott Johnson is Pres. and E. Buck, Ch. Engr., Denver. Noted on June 18.

GULF, TEXAS & WESTERN.—The charter applied for in Texas by this company has been approved. Company plans to build a line from Burrs Ferry, Tex., to Benjamin, Tex., about 500 miles. This company has taken over the Dallas & New Mexico Railway Co.'s properties. The officers are: Pres., Roy C. Megargel, New York; Vice-Pres. and Gen. Mgr., Ben B. Cain, Tyler, Tex.; Treas., W. Frank Knox, Tyler, Tex.; Secy., J. W. Pinson, Jacksboro, Tex. Other directors: J. J. Jermyn and R. B. Williams, of Scranton, Pa.; Oliver Loving, of Jacksboro, Tex., and L. M. Dabney, of Dallas, Tex. Headquarters will be at Dallas. Line will run via Tyler, Kaufman and Dallas. A branch may be built from Booneville to Fort Worth. Noted on Nov. 5.

KINGSTON RY.—Incorporated in Louisiana, with headquarters at Shreveport, La., to build a standard-gage railway from Kingston, La., to such points in Louisiana as may be decided upon by the Board of Directors. Capital, $10,000. Incorporators are W. R. Bradford, Pres.; R. E. Comegys, Secy. and Treas., both of Shreveport.

MIDDLE CAROLINA & WESTERN.—Cothran & Cothran, Engrs., Greenwood, S. C., have completed preliminary surveys. W. T. F. Warren is Gen. Mgr., Greenwood. Line will be 30 miles long.

MISSISSIPPI.—J. R. Buckwalter, Union, Miss., is building a standard-gage railroad from Union east nine miles for logging purposes. Two miles are graded, ties and rails are being received, etc.

MISSOURI & NORTH ARKANSAS.—The extension from Leslie to Helena, Ark., 180 miles, will be placed in operation by the end of the year, it is stated. Company now operates a line from Joplin to Leslie, 183 miles. W. S. Dawley is Ch. Engr., St. Louis, Mo. Noted on July 16.

METO VALLEY.—Incorporated in Arkansas with $32,000 capital stock. The company proposes to build a railroad from McCreanor, on the Rock Island Ry., a station a few miles east of Lonoke, a distance of 16 miles in a southerly direction in Lonoke County. The incorporators are E. C. Murray, S. M. Savage, C. P. Harnwell, E. S. Jett and R. J. Stroud, of Lonoke. The road is to be built for the purpose of developing the timber lands in the southern portion of Lonoke County.

QUEBEC & LAKE ST. JOHN.—We are officially advised that the location of the extension from Roberval northwest to St. Felicien, 20 miles, is nearly completed. Construction probably will be undertaken next season. Several survey parties are now locating a line toward Ha Ha Bay. This construction also will be carried on next season. W. H. Grant is Mgr. of Construction, Toronto, Ont.

RIVER VALLEY.—This company has been financed by William Wallace, Jr., H. K. Jones and T. W. Weir, all of Helena, Mont., and others. It will build and maintain a line of railroad through Shields River Valley, with terminals in Park and Meagher Counties, to connect with the Northern Pacific Ry. at Livingston, Mont.

SOUTHERN PACIFIC.—Seventy miles of roadbed and track on the main line of the Southern Pacific Ry.'s Sunset Route, near Dolgeville, Cal., are to be raised so that an easier grade may be established. The contract for this improvement has been let to ROBERT SCHERRER, of Los Angeles, Cal. Estimated cost, $100,000.

TEXAS SOUTHEASTERN.—We are officially informed that surveys have been made for the projected extension from Druso to Crockett, 29 miles. Company has not yet authorized construction, but probably will do so within a month. Right-of-way is partly obtained. Capital has been secured. Work will average about 15,000 cu. yds. per mile. This railroad now connects Diboll and Lufkin, Tex., 18 miles. T. L. L. Temple, Texarkana, Ark., is Pres.; J. E. Mitchell, Ch. Engr., Diboll, Tex.

ELECTRIC RAILWAYS.

WALTHAM, MASS.—A petition has been filed with the State Board of Railroad Commissioners, Boston, asking for a certificate that public necessity and convenience require the construction of an interurban electric railroad from Waltham to Marlboro, with a connection on the Waltham end with the Newton Street Railway System and thence with the Boston Elevated Ry. and connection at Marlboro with the Boston & Worcester Street Ry. The route as petitioned for is similar to that sought by the Boston, Waltham & Western Ry. Co. last summer, and the backers of the road now proposed are the same to quite an extent. The petition shows that the road is to begin at the terminus of the Newton Street Ry. on upper Main St. in Waltham, through Weston, Wayland and Sudbury to a point in Marlboro in Main St., near Howe, with a branch line running to Main St. in Maynard. Its length is to be 22½ miles. Capital stock of the

company is $500,000. A Board of Directors has been chosen, consisting of Fred T. Ley, of Springfield; P. P. Adams, of Waltham; Harold A. Ley and Morris H. Barnett, of Springfield, and F. R. S. Mildon, of Marlboro.

NEW YORK, N. Y.—Permission was granted on Nov. 17 by the Public Service Commission to the Pelham Park Railroad Co. and the City Island Railroad Co. to substitute a monorail line to be operated by electricity for their old horse car outfits. The route operated by the two companies runs from City Island to Bartow station on the New Haven & Hartford Railroad, about three miles. Noted on Oct. 29.

NEW YORK, N. Y.—Judge Lacombe, in the United States Circuit Court, granted permission on Nov. 16 to the Federal receivers of the Metropolitan Street Railway Co. to spend $200,000 proceeds from the sale of receivers' certificates in repairing the tracks of the Madison and Fourth Avenue Line. In a memorandum filed the judge agrees with the receivers that it would be bad business policy to abandon this important line, and says that if it is to be kept running repairs must be made when necessary. He says in this connection: "That the road is in a condition of great disrepair is manifest and not disputed. Efficient public service cannot be maintained without extensive repairs. Moreover, upon this line are run the new P. A. Y. E. cars, in which for insurance moneys and proceeds of receivers' certificates there is invested over $1,000,000. This rolling stock is exposed to much more rapid deterioration by being run over a road in such a wretched condition. It certainly seems a most shortsighted policy to expose this valuable property in which so much money is already invested to such adverse conditions of operation, which may be eliminated by putting the tracks in decent condition." Oren Root, 621 Broadway, is Gen. Mgr. for the Receivers.

AUBURN, N. Y.—The City Council has granted the Auburn & Syracuse Electric R. R. Co. an extension of time until Dec., 1900, on its franchise to construct a line westward to the city limits.

CHAMBERSBURG, PA.—The Chambersburg, Greencastle & Waynesboro St. Ry. Co. has applied to the Town Council for a franchise to build over streets in the northern part of Chambersburg with the expressed intention of extending its Chambersburg line to the Red Bridge, north of Chambersburg, if the franchise is granted. The franchise applied for by the C., G. & W. Co. conflicts with the franchise recently asked for by the Chambersburg & Gettysburg Elec. Ry. Co. The Council has not decided which line may have the franchise.

JOHNSTOWN, PA.—The Johnstown & Gallitzin Street Ry. Co. has awarded to PIERCE & BARNES, Civil Engineers, 7 Water St., Boston, Mass., the contract for making the surveys and preparing the plans and specifications for the proposed new electric line that will be built between this city and Gallitzin, a distance of about 25 miles. Three surveys will be started at once, one each from Johnstown, South Fork and Gallitzin. The surveys and preparation of the plans will take all winter and contracts will be awarded early in the spring, when actual construction will be started. There will be some particularly heavy construction and grading on the road, as it passes through some of the roughest and most mountainous parts of the State. Steel viaducts and bridges will also be built.

MONONGAHELA, PA.—The contract for construction of the Monongahela & Carroll Street Ry. has been awarded to PIHL & MILLER, Wabash Bldg., Pittsburg, Pa. The contract covers 14 miles of line, from Monongahela to Ellsworth, Pa., and will pass through Monongahela, Hazel Kirk, Braznell, Bentleyville and Ellsworth. Later the contracts for the remainder of the line, which will extend through to Washington, Pa., a like distance, will be awarded. Work is to be started at once, and continue throughout the winter. George M. Hosack, of Pittsburg, Pa., is Pres.

PITTSBURG, PA.—The Pan Handle Electric Co. has been chartered to construct an electric interurban road that will extend from Pittsburg and Carnegie, Pa., to Chester, thence down the West Virginia side of the Ohio River to Wheeling, W. Va. Capital stock, $80,000, of which $25,000 has been paid in. Incorporators, Joseph Byran, S. M. Dunbar and J. I. Merrill, Pittsburg, Pa.; H. R. Randolph, Sutersville, Pa., and Armor S. Cooper, New Cumberland, W. Va.

RICHMOND, VA.—The Richmond, Urbanna & Peninsular Railway Co. has voted to issue $300,000 of stock and $500,000 of 5% 40-year bonds. The proposed line, as noted fully last week, will extend from West Point to Urbanna, Va., with 60 branches, 116 miles in length. John C. Robertson, of Richmond, is Pres.; C. P. E. Burgwyn, of Richmond, is Engr.

FAIRBURN, GA.—The Fairburn & Atlanta Railway & Electric Co. has applied for a charter. It plans to build a line from Fairburn, Ga., to connect at College Park with the Atlanta street railway system. It will connect Union City, Stonewall and Red Oak, and will be about ten miles long. W. T. Roberts, of Fairburn is Pres.; J. H. Harris, of Union City, Secy., and J. H. Longino, of Fairburn, Treas. Directors are Dr. L. M. Hopgood, of Fairburn; G. A. Carmical, of Union City; J. F. Golightly, of Atlanta; Dr. J. B. Carmical and W. P. Mims, of Red Oak, Ga.

BIRMINGHAM, ALA.—G. T. Brazelton, Secy. and Treas. of the Edgewood Land & Improvement Co., 328-329 Hood Bldg., Birmingham, has stated, according to the Manufacturers' Record, that organization of the Birmingham & Shades Mountain Electric Railway Co. is not yet completed. Line will be about five miles long, extending from a connection with the South 15th St. line of the Birmingham Railway, Light & Power Co. It will accommodate the suburbs of Edgewood, Oak Grove and Rosedale. Noted on Nov. 5.

BAY ST. LOUIS, MISS.—A franchise calling for the construction of an electric street railway connecting the Jourdan River and Bay St. Louis, Miss., and other prominent resorts on the gulf coast, will be requested of the City Council of Bay St. Louis on Dec. 5. Estimated cost of construction is $1,500,000. Joseph T. Buddecke and H. L. Huntington, of New Orleans, are named as the promoters.

KOKOMO, IND.—We are officially informed that survey has been completed by the Kokomo Western Traction Co. and that maps, profile, etc., are being prepared for an interurban line from Kokomo, Ind., to Burlington, Ind., a distance of 15½ miles, opening up a large territory of rich and highly improved land. Burlington is 18 miles from Frankfort, 22 miles from Logansport and 15½ miles from Kokomo. There will be one 2-span bridge, 150 ft. long. Grading will be very light except two miles. Capital is being secured. Right-of-way is nearly all obtained. Company has decided to use independent gasoline motor cars for passenger, baggage, express and mail, and gasoline locomotive for local and car load freight. C. C. McFann, of Kokomo, Ind., Pres. and Gen. Mgr., states that he is now taking up the financing of the proposition and investigating the different equipment and material adapted to this work, information and quotations regarding which will be appreciated.

CHICAGO, ILL.—The Chicago, Joliet & Western Interurban Ry. Co., capital stock $10,000, has been incorporated. An electric line is to be constructed from Chicago to Joliet and west to other points in the Counties of Kendall, Grundy and La Salle as may be determined upon. The incorporators are C. Fox, Edward Ford, Andrew Ruttledge, Jr., F. E. Hinckly and Stephen A. Cross, all of Chicago.

DES MOINES, IOWA.—The Des Moines & Sioux City Elec. Ry. Co. has made financial arrangements for its proposed line. Nearly all the right-of-way has been secured from Des Moines, Iowa, northwest to Sioux City, about 192 miles. It is expected to begin work early next spring.

LITTLE ROCK, ARK.—The Little Rock & Hot Springs Electric Ry. Co. has amended its charter to provide for the issuance of $500,000 of preferred stock at 6%. The company contemplates building an electric railway from Little Rock to Hot Springs, a distance of 56 miles.

FORT WORTH, TEX.—Construction on the Fort Worth & Mineral Wells Electric Interurban Ry. is at a standstill at present. Company plans to build a railway 53 miles long. Right-of-way has been given and the line has been surveyed. Frank Catt is Engr, 408 West Belknap St., Fort Worth.

EL PASO, TEX.—The Mesilla Valley & El Paso Interurban Ry. Co. will be incorporated in New Mexico with a capitalization of $1,000,000. Surveying parties will enter the field at once and surveys will be made on both sides of the Rio Grande to determine the most practical route. As soon as the surveyors report the officers and directors will select the route for the upper valley interurban, to connect Las Cruces and other Mesilla Valley towns with El Paso. As noted on Nov. 5, this company recently incorporated in Texas, has elected the following officers: Z. T. White, of El Paso, Pres.; O. H. Baum, of El Paso, First Vice-Pres.; B. J. Viljoen, of Champerino, Second Vice-Pres.; W. A. Sutherland, of Las Cruces, Secy.; Oscar C. Snow, of Mesilla Valley, Treas. Noted on Sept. 10.

MARSHALL, TEX.—The City Council has granted M. Turney and associates a franchise to build and operate an electric street railway, and to furnish lights and power for a period of 25 years. The Marshall Traction Co. will be organized to take over this franchise. Noted on Oct. 15.

EL RENO, OKLA.—Henry Schafer, Pres. of the El Reno Interurban Railway Co., is quoted as saying that the proposed line from El Reno to Chickasha will soon be under construction. C. T. Blake, of Chickasha, is interested. Surveys have been made and right-of-way obtained.

CHICKASHA, OKLA.—Scott Jones has financed his plan to build eight miles of street railway. Construction will begin as soon as material can be delivered.

GRANTS PASS, ORE.—We are officially advised that the Rogue River & Oregon Southern Ry. Co.'s forces will construct the first ten miles of its proposed electric railway from Grants Pass to Waldo, Ore., 40 miles. Surveys are made and right-of-way secured. Capital has been obtained. H. B. Buddinborg is Pres., Seattle, Wash.; G. A. Collins is Ch. Engr., Grants Pass, Ore. Noted on Sept. 24.

FRESNO, CAL.—We are officially informed that the Fresno, Hanford & Summit Lake Interurban Ry. Co. will let contracts about Dec. 15 for building its proposed standard-gage electric railway from Fresno, passing through Colma, Malaga, Fowler, Selma, Kingsburg and Laton, the southern terminus being Hanford. As previously noted, this line will pass through a fruit raising district. It will be about 40 miles in length. The overhead trolley system will be adopted. It is planned to build the main power station at Kingsburg and the substations at Malaga and Laton, and also plans to build and operate two amusement resorts, one at Laton and the other on Kings River, a few miles east of Laton. Capital stock, $1,000,000. Surveys are made and right-of-way obtained. Officers: L. A. Lares, Fresno, Pres.; F. S. Granger, Hanford, Vice-Pres. and Gen. Mgr.; J. D. Biddle, Hanford, Secy. Chadwick & Sykes, Crocker Bldg., San Francisco, are Ch. Engrs.

SAN FRANCISCO, CAL.—The ordinance to grant to John J. Egan the right to run street railway lines over 240 miles of San Francisco streets was voted upon by the people of San Francisco on Nov. 3 and defeated.

SAN PEDRO, CAL.—Application has been made to the City Trustees by William Peck and E. D. Seward for a railway franchise on several city streets and along Palos Verdes St. to Santa Cruz. This line would practically make a complete system from Point Firmin on the south to the northern end of the city.

BERKELEY, CAL.—The Town Trustees have granted to the San Francisco, Oakland & San Jose Consolidated Ry. Co. a franchise to build its line along Sacramento St., from the southern boundary of the city to Hopkins St., and along that thoroughfare to the northern boundary of the city. The franchise is to run 48 years. Work is to be commenced within one year and is to be completed within three years. The road may eventually be extended to Martinez. W. F. Kelly is Gen. Mgr., 710 San Pablo Ave., Oakland, Cal.

The Southern Pacific Co. has applied for permission to electrify its present lines, and for additional franchises, which if granted, will give the railroad five lines, extending from the southern to the northern boundaries of Berkeley. The railroad also announced its intention of extending its present lines into Contra Costa County, so as to form a loop. W. B. Scott, Gen. Mgr. of the Western division of the Southern Pacific, announced that the road was ready to begin work immediately on transforming its system on the new lines. Estimated cost is $2,000,000.

STOCKTON, CAL.—W. H. Newell, Pres. and Ch. Engr. of the Stockton Terminal & Eastern R. R. Co., Stockton, advises us that construction contracts will be let early in 1900. The line will be about 30 miles long and will connect Stockton, Waterloo, Linden, Bellota and Jenny Lind. Right-of-way and capital have been secured and surveys made. Noted last week.

GOLDFIELD, NEV.—The Board of Commissioners of Esmeralda County has granted a franchise to the Goldfield Traction Co. to build a street railway in Goldfield, Columbia and Diamondfield. One mile of the line must be completed and in operation by June 30, 1900. The maximum fare that may be charged for carrying a passenger within the limits of Goldfield is 15 cts. and 30 cts. to Diamondfield. Freight may be hauled over the company's lines between the hours of 10 p. m. and 6 a. m. George Wingfield, Thos. F. Manning and L. T. Merwin, of Goldfield, are the promoters.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

ESSEX JUNCTION, VT.—The Burlington Light & Power Co. will develop the water power privileges at Essex Junction at the Hunter & Shiland and the Brownell privileges on the Winooski River, according to the Burlington "News." The company will build a dam below the present Hunter & Shiland dam of concrete. From it there will be a fall of 75 ft. The boulders in the bed of the river above the Brownell dam are to be removed, giving a free water runaway. The height of the new dam will set the water back as far as the iron bridge on the Central Vermont Ry. and this storage basin will hold a volume of water forming a lake. A power-house will be constructed below the dam on the Essex side of the river, near the site of the present Brownell saw mill. Work on this undertaking will be begun early in the spring. It is expected that the power will be ready to be utilized before the winter of 1900 sets in. J. J. Kennedy, 52 Broadway, New York, is Engr.; F. H. Parker, Burlington, is Mgr. Estimated cost, $250,000.

NORTH ADAMS, MASS.—The North Adams Gas Light Co. is planning to construct an electric light plant. The cost of the plant is estimated at $100,000. The plant will have an output of 4,000 HP. H. T. Cady is Pres.

WINCHENDON, MASS.—Repairs are to be made by William M. Whitney, Pres. of the Winchendon Electric Light & Power Co. at Centreville, which include the construction of a flume 16 ft. deep and 19 ft. wide; a new concrete dam, 105 ft. long and 12 ft. wide. A power-house is to be built on the bank of Millers River, which will be operated as an auxiliary to the present electric plant. The cost of the work is estimated at about $10,000 and will increase the output of the plant about 350 HP. The company will furnish electricity to operate the new chair factory of Brown & McColley.

NEW YORK, N. Y.—Bids are asked until 2.30 p. m., Dec. 2, by Robert W. Hebberd, Comr. of Public Charities, for the complete conduiting, electric wiring and all other work in connection with the installation of a complete electric lighting and power system for certain of the buildings and grounds under the jurisdiction of the Department of Public Charities, and included in the Metropolitan Hospital District, Blackwell's Island, Boro. of Manhattan.

READING, PA.—Arrangements are being made by the Reading Power Co. to erect a power plant near the mouth of the Wyoming Creek on Schuylkill River, near Reading. The equipment will include seven steam turbines with a rating of 3,200 KW. each. The cost of the plant is estimated at $1,500,000 and will furnish electricity for operating the electric railway system throughout the Schuylkill and Lebanon Valleys. The old power plants of the company will be used as transformer stations.

PHILADELPHIA, PA.—The Chester County Electric Co., it is reported will improve its plant at Kennett Sq., at a cost of $20,000. E. W. Meloney, Avondale, is Supt.

CONNEAUTVILLE, PA.—Edward B. Fish and E. H. Fisher, both of this city, have applied to councils here and at Springboro, Pa., a short distance from this city, for a franchise for an electric light plant to be erected here at once. It is proposed to furnish light both for the streets and private consumers at both places. They guarantee to furnish electric light to both places much cheaper than they are now getting it. The matter will be decided at the next meeting of the Council, which will be held the first week in December.

BEAVER FALLS, PA.—THE BEAVER VALLEY ELECTRIC CO. has been awarded the contract this city, has electric light to be used furnishing the streets and public buildings lighting the for a period of five years. The company nish 90 or more arc lights for 200 c.-p. each at a flat rate of $65 per year; per lamp; candescent lamps at $1.50 per month for 25 c.-p. and $2.40 per lamp per repairs and new lamps are c.-p. All furnished by the light company be made and

WASHINGTON, D. C.—Bids are asked by the Commissioners of the District of Columbia, until 2 p .m., Nov. ing the District governments for furnishboards, conduits and cables with switch-McKinley Manual Training use in the

ROANOKE, VA.—The Craig Water Power Co., recently incorporated, planning to construct two hydro-electric plants, one with an output of 800 HP. and other 1,800 HP., and will erect a plant in Roanoke to furnish electricity for lamps and motors in this city. C. S. Wenges, of Bonnystown, Pa., is preparing plans and specifications for the plants. A. L. Sibert is Pres.

AUGUSTA, GA.—The Twin City Power Co. has awarded a contract to the AMBURSEN HYDRAULIC CONSTRUCTION CO., 176 Federal St., Boston, Mass., for the erection of a reinforced concrete dam across the Savannah River at Price's Island, about 25 miles above Augusta, and work will commence as soon as plans are approved by the U. S. Government. The company will erect two dams across the Savannah River, of which the one at Price's Island will be the first. It will be 30 ft. high and of sufficient thickness to permit of a roadway suitable for cars and wagons to cross it, serving also as a bridge across the Savannah. It will cost approximately $3,500,000, and will furnish 15,000 HP., the greater part of which will be transmitted to Augusta and used by manufacturing companies. The sub-station of the company will be located in North Augusta and the power needed will be switched off from that point. The survey for the transmitting lines has already been completed and consequently there will be no delay along this line. The Government will pass upon all plans for the dam and the permit will then be given for the work. This will be done on or before Dec. 5, it is stated. The second dam, which will be constructed later, will be at Dorton's Creek, higher up the river. It will be similar to the dam at Price's Island and the power will be transmitted to whatever point it is sold. Nisbet Wingfield, Comr. of Public Works, Augusta, has been engaged as Ch. Engr., and will supervise construction.

CHATTANOOGA, TENN.—The Chattanooga-Tennessee River Power Co., which is constructing a water-power-electrical plant at Hale's Bar, will begin construction work on sub-station in South Chattanooga soon. It will be of brick, 50 × 100 ft., and three stories high; will contain step-down transformers to reduce voltage of current from 44,000 to 4,000 volts, and steel tower 30 ft. high that will receive six transmission wires. According to the "Manufacturers' Record," the distance from the power plant on Tennessee River to sub-station will be about 17 miles. Transmission cables will be supported by 163 steel towers, placed 622 ft. apart. About eight miles of route has been cleared of timber. The company expects to ultimately develop 56,000 HP. John Bogart, 16 Exchange Pl., New York, is Engr. for company; Byron T. Burt, Local Mgr.

LIMA, OHIO.—We are officially advised that the Board of Public Service has selected C. E. F. Ahlm, Engr., Caxton Bldg., Cleveland, Ohio, to prepare plans and specifications for the proposed municipal electric light plant. Estimated cost, $80,000. The plant will be operated by steam and will supply 300 arc lamps. It is probable that contract will be let the latter part of December.

CINCINNATI, OHIO.—Bids are asked until 2 p. m., Dec. 11, by Col. William T. Rossell, Corps Engrs., U. S. A., Cincinnati, for building a power-house at Dam No. 37, Ohio River.

COLUMBUS, OHIO.—Bids are asked until 10 a. m., Nov. 25, by Capt. H. J. Hirsch, Constr. Q. M., Columbus Barracks, for furnishing and installing transformer, etc., and making underground electric service connections to new post hospital, new bakery, disinfecting plant, and new hospital corps sergeants' quarters at Columbus Barracks.

HARTFORD CITY, IND.—Henry Charles, of Marion, Ind., plans to construct a gas plant in this city.

CHICAGO, ILL.—The proposition authorizing a bond issue of $20,000,000 by the state of Illinois to continue the construction of the lakes to the gulf deep waterway from Joliet toward St. Louis, was carried at the election held Nov. 3. The plans call for an expenditure of $17,000,000 in digging a canal 22 ft. deep and 140 ft. wide to Utica on the Illinois River, and an expenditure of $3,000,000 for the construction of electric power plants on the Illinois and Des Plaines Rivers. It is estimated that the plants will bring a revenue of $2,500,000 a year. Col. W. H. Bixby, Pres. of the Mississippi River Commission, is making surveys and investigations pertaining to the project.

CEDAR RAPIDS, IOWA.—We are advised that the Cedar Rapids & Iowa City Railway & Light Co. has had a survey made for a power plant to be located at Palisades, and has brought an action in court to condemn land overflowed. The local press states that a dam is to be built 16 miles down the Cedar River from this city, 20 ft. high. The plant will be operated by water, supplemented by steam. The power will be used to operate the street railway system, owned by the company, and for lighting. J. D. Wardle, Cedar Rapids, is Supt.

KEOKUK, IOWA.—The Keokuk & Hamilton Water Power Co. has been reorganized. Press reports state that work will be started on [illegible]. It will cost $15,000,000 a year to construct the plant. Hugh L. Cooper, 60 Wall St., New York, is Vice-Pres. and Engr.

REDWOOD FALLS, MINN.—Arrangements are being made by A. C. Burmeister for the construction of a hydro-electric plant at a cost of about $20,000. The equipment will include two 100-KW. alternating-current generators and water wheels.

BUFFALO, MINN.—The contract for constructing the electric light plant here has been awarded to the NORTHWESTERN ELECTRIC EQUIPMENT CO., 181 East Fourth St., St. Paul, Minn. O. Claussen, National German American Bank Bldg., St. Paul, Minn., is Engr. H. O. West, Buffalo, is Recdr. Cost, $5,000.

ST. MARYS, KAN.—See item under Water Supply—Irrigation.

HUBBARD CITY, TEX.—We are officially advised that the Union Central Light & Ice Co., W. A. Bass, Pres., is planning to arrange for plans, specifications and construction of the proposed electric light plant. The plant will cost $10,000 and will supply lighting and power and will manufacture ice. Engines, boilers, dynamos and wire will be required.

ASHLAND, ORE.—The WASHINGTON PIPE & FOUNDRY CO., of Tacoma, Wash., has been awarded contract for constructing a pipe-line for the municipal power plant at Ashland, at $14,613.

SACRAMENTO, CAL.—The Great Western Power Co., Crocker Bldg., San Francisco, has secured an option on a site at Eighth and R Sts. for its proposed power distributing plant, supply station and repair shop. The main transmission line will be tapped at Perkins, where a sub-station will be built. The transmission lines of the company will be placed underground in the business section of the city.

IMPERIAL, CAL.—J. T. Boyd and Dr. G. H. Kreichbaum of Los Angeles, Cal., are contemplating the establishment of a gas plant at Imperial. They expect to install a plant costing $80,000.

NORTH SAN JUAN, CAL.—Steps have been taken for establishing a hydro-electric power plant by relocating the old North San Juan ditch, according to plans of A. A. Sager and Mr. Beverton, both of North Bloomfield. They have located a dam site on the Middle Yuba River, about a mile above the old dam. The ditch has a total length of seven miles, and at its terminal point, near San Juan, will give 1,000 ft. of pressure for the power plant. Sager & Beverton have secured a site for such a plant. The power will be carried to the Sacramento Valley.

WALLACE, IDAHO.—Jesse Freeman, and associates, of Wallace, have made application to the city for a franchise to install and operate an electric light and power plant for a period of 30 years. Those interested with Mr. Freeman in the project are William Stites, Thomas McGowan, D. L. Hopkins and George Baldwin. The parties named have located a site for a plant on Slate Creek. The transmission line will be about 15 miles in length, and the cost of the plant is estimated at about $1,250,000.

SANDPOINT, IDAHO.—J. F. Reynaud, Mgr. of the Pend d'Oreille Electric Co., advises us that contracts will be let in January for a power plant to be built here at a cost of $400,000. Water-wheels, dynamos, switchboard, transformers (60,000 volts), water-wheel governors, high voltage insulators, etc., will be required. The power will be supplied by the Moyea Falls. H. M. Byllesby & Co., 123 Monroe St., Chicago, Ill., are Engrs.

TORONTO, ONT.—Contracts for the materials which will go to make up the Government transmission line between Niagara Falls and the municipalities receiving electricity from the Hydro-Electric Power Commission of Ontario, have been made by F. H. McGuigan, general contractor, and his associates. The footings for the towers which will carry the wires are now finished. They are supplied by the CANADIAN BRIDGE CO., of Walkerville, and the ONTARIO IRON & STEEL CO., of Welland. The towers themselves will be obtained from the CANADIAN BRIDGE CO. Aluminum cables will be purchased from the ALUMINUM CO. OF AMERICA, at Shawinegan Falls, Que. Hon. Adam Beck is Chn. Comn.

SAULT STE MARIE, ONT.—The Lake Superior Power Co. is making plans for the construction of a hydro-electric plant to have an output of 6,300 HP., the cost of which is estimated at $110,000. L. H. Davis is Ch. Engr.

LETHBRIDGE, ALTA.—We are officially advised that Smith, Kerry & Chace, Engrs., Confederation Life Bldg., Toronto, Ont., are preparing plans for a water supply system and lighting plant for this city. The system will be operated by steam and will supply 30 arc lamps and 7,000 incandescent lamps. The plant will have a capacity of 1,000 KW. in three units for light and power. Cost, $75,000.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

HYDE PARK, MASS.—Bids have been opened for construction of a double arch reinforced concrete bridge at Bridge St., Hyde Park, over Neponset River. The lowest bid received was that of the Bryne Construction Co., of Boston, at the following prices: 1,000 cu. yds. excavation, 60 cts.; 1,200 cu. yds. [illegible] 50 cts.; 850 cu. yds. concrete, $8; two 45-ft. arches, $5,000; 232 lin. ft. coping, 70 cts.; 224 sq. yds. granolithic, $2; and 25 cu. yds. rock excavation, $3; total, $13,699. Other bidders were: Emerson & Norris, $24,-500; Aberthaw Construction Co., $23,970; Falvey & Kelly, $22,205; M. F. McCarthy, $19,-[illegible]; John A. Rooney, $19,487; W. A. Murtfeldt Co., $18,472; J. Cashman, $17,887; Armstrong Construction Co., $17,380; George Bryne, $17,198; Hanscom Construction Co., $16,609; O'Connor & Andrews, $16,057; Ley Construction Co., $14,419. C. G. Norris is Town Engr.

BARRINGTON, R. I.—The Town Council is considering the construction of a riprap wall and repairs to the Barrington River bridge. Estimated cost, $14,000.

KENWOOD, N. Y.—The contract recently awarded to Skinner & Tibbitts, of Oneida, N. Y., for the construction of a concrete bridge over the Oneida Creek, near Kenwood, has been rescinded. New bids will be asked.

PLATTSBURG, N. Y.—The proposition to erect a new bridge over the Saranac River, at Caroline St., has been approved by the Village Council. Bids will soon be asked. Estimated cost, $5,000. Ralph L. Signor is Village Engr.

HACKENSACK, N. J.—The Board of Chosen Freeholders on Nov. 2 awarded the contract for constructing a bridge over the Hackensack River from Riverview Pl., Hackensack, to Railroad Ave., Ridgefield Park, to the F. R. LONG CO., of Hackensack, at $153,185.

PHILADELPHIA, PA.—Bids will be received until Nov. 20 by George R. Stearns, Dir. Pub. Wks., Bureau of Water, for constructing a suspension bridge to the Intake House No. 1 at the Torresndale filter station, contract No. 153.

PORTLAND, PA.—The Delaware, Lackawanna & Western R. R. Co. has been granted permission to construct a concrete arch bridge over the Delaware River here. Lincoln Bush, Hoboken, N. J., is Ch. Engr.

READING, PA.—The Council Committee is considering constructing a bridge over the Lebanon Valley R. R. tracks at Tulpehacken St. Elmer E. Beard is City Engr.

WILKES-BARRE, PA.—The Grand Jury has recommended that the County Commissioner construct 27 new bridges throughout the county; 14 stone arch bridges, costing from $300 to $600 each, eight concrete bridges, and five iron bridges.

BOWLING GREEN, VA.—The Caroline County Commissioners have approved the plans submitted by the Roanoke Bridge Co., Roanoke, Va., for the construction of a steel bridge across North Anna River to connect Caroline and Hanover Counties.

CHARLESTON, W. VA.—The Farris Bridge Co. has been incorporated with $25,000 capital stock by Geo. W. McClintic, W. G. Mathews, M. I. Stiles and others.

GREENVILLE, S. C.—Bids will be received until Nov. 25 by the Supervisors of Greenville and Pickens Counties for constructing a new span to the bridge over the Saluda River between the counties. J. P. Goodwin is County Superv., Greenville County.

LEXINGTON, S. C.—The JOLIET BRIDGE & IRON CO., Joliet, Ill., has secured the contract at $15,575 for the construction of a bridge over Saluda River. Bids were opened on Nov. 5.

PENSACOLA, FLA.—Bids are asked by the Escambia County Commissioners until Nov. 21 for the construction of a wooden bridge across Little Bayou. A. M. McMillan is Clerk Bd. County Comrs.

XENIA, OHIO.—J. K. SPENCER and JOHN BURNETT, Lebanon, Ohio, have secured the contract for fills for approach of the Roxanna bridge over the Little Miami River, Spring Valley Township. S. M. McKay is County Engr.

PHILO, OHIO.—The Board of Commissioners of Muskingum County, Zanesville, have awarded the contract to CLIFTON BROS., Zanesville, for constructing a concrete abutment at the west end of the river swing bridge at Philo. L. E. Breisford is County Audr., Zanesville.

CLEVELAND, OHIO.—The City Engineer is preparing plans for the construction of a bridge at West 25th St. at Walworth Run. The bridge will be ⅓ mile long. Estimated cost, $350,000.

COSHOCTON, OHIO.—Waddell & Harrington, Consult. Engrs., New Nelson Bldg., Kansas City, Mo., have prepared plans for the construction of two steel or reinforced-concrete bridges for Coshocton County. One bridge will have six and the other nine 110-ft. spans. Bids will be asked in about one month.

GREENFIELD, IND.—GEORGE WHISLER has been awarded the contract by the County Commissioners for the construction of the Copeland bridge. Chas. H. Troy is County Audr.

*EVANSTON, ILL.—Bids are asked by the Board of Trustees of the Sanitary District of Chicago, American Trust Bldg., Chicago, until noon, Dec. 2, for the superstructure of the Chicago, Milwaukee & St. Paul Ry. bridge, the work consisting of the fabrication, erection and completion of the superstructure of a railroad bridge at the crossing of the Chicago, Milwaukee & St. Paul Ry. over the North Shore Channel of the Sanitary District of Chicago, near Chancellor St., Evanston, the work to be completed on or before June 1, 1909. I. J. Bryan is Clk.

*GREEN BAY, WIS.—Bids will be received by the City Clerk until 2 p. m., Dec. 14, for the construction of a bridge over Fox River at Walnut St. Four 140-ft. fixed spans, one movable span (bascule), 114 ft. Plans are on file at the office of Engineering News, New York; Strauss Reinforced-Concrete & Bascule Bridge Co., 903 Fort Dearborn St., Chicago, Ill.; City Clerk's office, Green Bay. W. W. Reed is City Engr.

ST. PAUL, MINN.—The St. Paul Bridge & Terminal Ry. Co. has awarded contract to W. G. HOY, of St. Paul, for the grading and piles for bridges on the line now under construction from South St. Paul, Minn., to St. Paul yards at Dayton's Bluff, 2¾ miles. There is to be a steel bridge over the Mississippi River with pile trestle approaches. Alfred Jackson, St. Paul, is Engr.-in-Charge. This project was fully noted under "Railways" on Oct. 15.

ST. PAUL, MINN.—The Park Board on Nov. 5 awarded the contract for constructing a bridge across the Phalen-Gervais Creek to BAYNE & HEWETT, Minneapolis, Minn., at about $6,000.

LEAVENWORTH, KAN.—A. Maduska, City Engr., is preparing plans for a 40-ft. span reinforced-concrete arch bridge, 20-ft. raise, for the city. J. H. Kirmeyer is City Clk.

MISSOULA, MONT. — Bids will be received until 10 a. m., Nov. 23, at the office of the County Clerk and Recorder of Missoula County for the construction of a bridge across the Missoula River. F. L. Smith is Clk. County Comrs.

HOPE, ARK.—Five steel bridges will be constructed in the county in 1909.

*AUSTIN, TEX.—William P. Carmichael & Co., Fullerton Bldg., St. Louis, Mo., submitted the lowest bid at $176,495 on Nov. 5 for the construction of a reinforced-concrete arch bridge at the foot of Congress Ave. across Colorado River; the structure to consist of eight spans, each 110 ft. long, roadway 38 ft. wide and two sidewalks, each 5 ft. wide. Waddell & Harrington, Consult. Engrs., Kansas City, Mo. John W. Hornsby is County Judge.

DALLAS, TEX.—The city is considering the construction of a concrete bridge in connection with the construction of an underground crossing at the intersection of Hall St. and Missouri, Kansas & Texas Ry. Estimated cost, $4,000. J. B. Winslett is City Secy.

SAN BERNARDINO, CAL.—Bids are asked until 11 a. m., Nov. 23, by the County Supervisors for constructing a 30-ft. I-beam bridge over Missouri storm drain on Colton Ave.

LATHROP, CAL.—Bids will soon be asked by the county for the construction of a 400-ft. bridge across the Missoula River here.

HAVELOCK, N. B.—Bids will be received by John Morrissy, Ch. Comr. Dept. Pub. Wks., Fredericton, N. B., until noon, Nov. 30, for rebuilding the Havelock Village culvert in Havelock Parish.

LEPREAU, N. B.—Bids are asked until noon, Nov. 30, by John Morrissy, Ch. Comr. Dept. Pub. Wks., Fredericton, N. B., for rebuilding the Mill Pond bridge over Little Lepreau River.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

CHELSEA, MASS.—We are advised by Kilham & Hopkins, Archs., 9 Park St., Boston, Mass., that they have let contract to WHITON & HAYNES, John Hancock Bldg., Boston, for construction of the Williams School which, according to present plans, is to be the center of one of a group of school buildings. The central building will be located on a site enclosed by Arlington, Walnut, Fourth and Fifth Sts. This is a double city block 550 ft. in length and 260 ft. wide. The building will contain 20 classrooms, an assembly room capable of seating more than 1,000 persons, and a central heating plant. At some future time as the needs require it is the idea of the city to erect two other buildings at the right and left from Walnut St., the three buildings inclosing a court 300 × 130 ft. The buildings will be of the fireproof construction of red brick, with trimmings of light terra cotta. There will be four fireproof staircases in the central building. Estimated cost, $160,000.

Ward & Noble, Archs., Boston, have plans for a church for the Central Congregational Society of Chelsea to cost $60,000.

EAST PROVIDENCE, R. I.—The following bids have been received by the Joint Building Committee for erecting a high school: General construction—D. J. Barry, $61,130; J. W. Bishop & Co., $59,450; William Williams, $61,000; Humes Construction Co., $62,-500; E. K. Watson, $58,925; Harding & Hamlin, $62,395; Vinton I. Reynolds, $56,980. Plumbing—Thomas E. Manney, $5,700; M. F. Murphy, $5,550; H. Dauphinee, $5,380; F. G. Lees, $5,125; Davey Bros., $4,775. Heating—Allen Fire Dept. & Supply Co., $4,293; Samuel Jackson Co., $4,979; H. B. Smith Co., $4,630.

NEW YORK, N. Y.—Bids are asked until 2.30 p. m., Dec. 1, by Robert W. Hebberd, Comr. Dept. of Public Charities, for removing the four hospital pavilions located on the grounds of Bellevue Hospital and erecting same at the Metropolitan Hospital, Blackwell's Island, the City of New York.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Nov. 30, by John W. Brannan, Pres. Bd. of Trustees, Bellevue and Allied Hospitals, for the excavating, piling, masonry, fireproofing, waterproofing, carpenter, steel, electric, heating and ventilating, plumbing and other work for the boiler house and cooling station of the new Bellevue Hospital, situated on First Ave. and bounded by 26th and 27th Sts., Boro. of Manhattan.

We are advised by Radcliff & Kelley, Archs., 3 West 29th St., that they will take estimates about Dec. 1 on a 6-story brick and stone, semi-fireproof warehouse, to be 34 ft. on Greenwich St., and 76 ft. on Canal St. The building will be constructed for Edward D. Depew, 14 Harrison St., and will cost $60,000.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Nov. 30, by Alfred Brooks Fry, Ch. Engr., Supt., etc., U. S. Custom House, New York, for certain alterations, mainly on first and mezzanine floors, of the U. S. courthouse and post-office, New York, N. Y.

Designs for eight buildings of the proposed Riker's Island penitentiary, which will cost $4,000,000, have been approved at a meeting of the Municipal Art Commission. Trowbridge & Livingston, 424 Fifth Ave., are Archs. The designs comprised those of the administration building, to cost $400,000, with walls of light brick; the men's cell building radiating from the administration building on four sides, to cost $1,000,000, and the women's cell building, to cost $350,000; the men's chapel, to cost $80,000; the men's mess hall and women's mess hall and chapel to cost $80,000, and $50,000 respectively, and the men's bathhouse and men's shops, to cost $36,000 and $40,000 respectively.

Plans have been filed with the Buildings Superintendent for two 6-story apartment houses to be built on Audubon Ave., from 176th to 177th Sts., for the Washington Heights Development Co., Henry L. Feit, Pres. They are to be of the Renaissance design, with facades of brick, and trimmings of limestone and terra cotta. They will have a frontage of 100 ft. each and a depth of 80.11 ft. and are to cost $500,000. Mulliken & Moeller, 7 West 38th St., are Archs.

We are officially advised that C. P. H. Gilbert, Arch., 1123 Broadway, is taking estimates for construction of a residence to be erected at Fifth Ave. and 89th St., for Benjamin N. Duke, Plaza Hotel. The building will be six stories high, 34 × 108 ft. and will be built of stone. Cost, $190,000.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Dec. 3, by J. W. Stevenson, Comr. of Bridges, for the construction of the foundations for the Municipal Building.

The following bids were received by Louis F. Haffen, Pres. Boro. of the Bronx, on Nov. 9, for the erection and completion of stable building, wagon house and tunnel for the use of the Bureau of Highways of the Borough of the Bronx, to be erected on a plot of land situated on the north side of East 181st St., bounded by Webster Ave. and Park Ave., Boro. of the Bronx: Thomas A. Buckley Construction Co., $35,970; Howard C. Kelly, $37,890; Thomas Cockerill & Son, 147 Columbus Ave., $39,800; Kelly & Kelley, Inc., 45 East 42d St., $37,469; Concourse Construction Co., 2065 Ryder Ave., $35,189; Guidone & Gilardi, 1 Madison Ave., $37,350; William Horne Co., 71 West 132d St., $36,-900; J. F. Walsh & Co., 1 Madison Ave., $38,000.

A. V. Porter, 621 Broadway, Arch. for the Receivers of the Metropolitan Street Ry. Co., has plans in progress for a car barn of brick construction, three and five stories, to cover a plot of about 134 × 206 ft., at the corner of Ninth Ave. and 54th St. It is expected that plans will be ready to submit to bidders on or about Nov. 25.

NEW YORK, N. Y.—Nelson & Van Wagenen, Archs., 44 West 39th St., New York, advise us that they will take estimates in about two weeks for a 3 and 5-story brick and stone church and day nursery, 75 and 113 × 113 ft., for the Madison Ave. Reformed Church, Madison Ave. and 57th St. The proposed structure will be built at First Ave. and 67th St., and will cost $100,000.

Bids are asked until 2.30 p. m., Nov. 30, by Robert W. Hebberd, Comr. of Dept. of Public Charities, for the excavation, masonry, steel and iron work, roofing and metal work, carpentry, electric work, heating and ventilating work, plumbing work and all other work, as set forth in the drawings and specifications for the construction and entire completion of a tuberculosis infirmary for the Metropolitan Hospital District, Blackwell's Island, Boro. of Manhattan.

Bids are asked until 10.30 a. m., Nov. 25, by Nicholas J. Hayes, Fire Comr., for furnishing all the labor and materials required for additions and alterations to quarters of Hose Company No. 2, located on west side of Greenwood Ave., north of Atlantic Ave., Richmond Hill; for additions and alterations to quarters of Hook and Ladder Company No. 76, located at Irving Pl. and Broadway, Jamaica; for additions and alterations to quarters of Engine Company No. 170, located on west side of Willow Ave., north of Jamaica Turnpike, Richmond Hill.

We are officially advised that Cram, Goodhue & Ferguson, Archs., 170 Fifth Ave., New York, have been retained to prepare plans for a church to be built for the congregation of South Church. Rev. T. R. Bridges is Pastor.

NEW YORK, N. Y.—Bids are asked until 2.30 p. m., Nov. 27, by Robert W. Hebberd, Comr. Dept. of Pub. Charities, for the cooking service equipment (including refrigerators), gas and electric fixtures and fitting up (other than that of closets and linen rooms) and all other work as set forth in the drawings and specifications, for the erection and entire completion of a residence for the superintendent, a residence for the medical staff, and a dining hall and kitchen building, in connection with the City Hospital, at Blackwell's Island.

BUFFALO, N. Y.—Charles Mosier, Park Comr., intends to erect an 8-family apartment house on the West Side similar to the one he recently completed at Linwood Ave. and Barker St. Cost, $100,000.

BUFFALO, N. Y.—The Buffalo Orphan Asylum, which has acquired a site on Elmwood Ave., opposite Delaware Park, has authorized the preparation of plans for building by Esenwein & Johnson, Archs., Ellicott Sq. The buildings to be erected are an administration building, boys' and girls' ward, infants' ward, school and gymnasium and boiler house. All to be equipped with modern appliances. Cost, $200,000.

CHAUTAUQUA, N. Y.—The Chautauqua Association will erect a 2-story brick and stone store and business building on the Chautauqua Assembly grounds to replace the building burned recently. Green & Wicks, Archs., 110 Franklin St., Buffalo, are preparing plans. The cost will approximate $40,000.

SYRACUSE, N. Y.—Plans are being prepared by Albert L. Brockway, Arch., Syracuse Savings Bank Bldg., for a 10-story, 200-room addition and general remodeling of the Yates Hotel for the Yates Hotel Co. Estimated cost, $300,000.

ELMIRA, N. Y.—Pierce & Bickford, Archs., 118 Lake St., Elmira, have been retained to prepare plans for remodeling an addition to the Academy building for the Board of Education. The work will cost about $75,000.

SCHENECTADY, N. Y.—The following bids were received by the Board of Supervisors of Schenectady County on Nov. 10 for the construction of a court-house building on State St., Schenectady: (1) For general

construction in terra cotta and brick; (2) for general construction in limestone and brick; (3) for plumbing, heating, ventilating, electrical wiring, conduits and elevators: John Gill & Son, 12 West 31st St., New York, (1) $347,000; (2) $385,000; (3) $82,500. John T. Brady & Co., 105 Park Ave., New York, (1) $350,510; (2) $391,000; (3) $49,330. Brown & Lowe, Schenectady, N. Y., (1) $402,973; (2) $438,000; (3) $88,068. Andrew Kinum & Son, Schenectady, N. Y., (1) $395,592; (2) $425,792; (3) $97,320. The Norcross Bros., Worcester, Mass., (1) $412,000; (2) $442,000; (3) $89,000. Charles H. Peckworth, 415 Hudson St., New York, (1) $367,174; (2) $407,409; (3) $71,314. V. J. Hedden & Son Co., 1 Madison Ave., New York, (1) $435,020; (2) $442,788; (3) $85,213. Cramp & Co., 36 East 23d St., New York, (1) $361,776; (2) $401,646; (3) $77,449. J. E. & A. L. Pennock, Land Title Bldg., Philadelphia, Pa., (1) $388,383; (2) $393,800; (3) no bid. Kelly & Kelley, 45 East 42d St., New York, (1) $399,624; (2) $435,474; (3) $84,118. Herman Probst, 10 West 29th St., New York, (1) $374,700; (2) $420,400; (3) $83,500. R. T. Ford Construction Co., Rochester, N. Y., (1) $435,000; (2) $495,000; (3) $93,000. James D. Doak & Co., 1420 Chestnut St., Philadelphia, Pa., (1) $409,997; (2) $439,621; (3) $80,000. Andrew J. Robinson, 123 East 23d St., New York, (1) $374,392; (2) $400,897; (3) $74,750. Woodbury & Leighton, New York, (1) $374,744; (2) $395,744; (3) no bid.

The following bids were received for the interior work only: Heating and ventilating: E. W. Hollister, Schenectady, $40,275; Stevenson Bros., Schenectady, N. Y., $39,800; John W. Danforth Co., Buffalo, N. Y., $39,960; Edward Joy, Syracuse, $37,375. Plumbing: E. W. Hollister, $20,640; Stevenson Bros., $26,000. Electric wiring and conduits: James F. Burns, Schenectady, N. Y., $9,675; G. S. Sauter-Sanderson Co., Schenectady, N. Y., $6,000; John Kelley, Schenectady, N. Y., $10,233; Hadzel & Buehler, Buehler, New York, $10,350; Edward Joy, Syracuse, N. Y., $15,875.

RIDGEWOOD, N. J.—Frederick W. Wentworth, Arch., Citizens' Trust Bldg., Paterson, N. J., is about to let contracts for a 3-story brick and limestone bank and business building, 80 × 80 ft., to be built at Ridgewood, for the Ridgewood Trust Co., Peter Zabriskie, Chn. Bldg. Com. Cost, $45,000.

ATLANTIC CITY, N. J.—We are officially advised that the W. D. Prouse Co., Land Title Bldg., Philadelphia, will erect two 8-story fireproof apartment houses, 200 × 105 ft., at Atlantic City. The buildings will be constructed of concrete, brick, stone and terra-cotta, and will cost, together, $500,000. They will contain service and passenger elevators, engines, dynamos, mail chutes, etc. Henry Ives Cobb, 42 Broadway, New York, N. Y., is Arch.

EAST ORANGE, N. J.—Eugene A. McMurray, 22 Clinton Ave., Newark, and W. Pell Pulis are working on plans for a 16-family apartment house, to be erected on William St., East Orange, by James J. Allen. The building will be brick, 4 stories, 40 × 104 ft. The estimated cost is $40,000.

NEWARK, N. J.—Hyman Rosensohn, Arch., 747 Broad St., Newark, is drawing plans for four 4-story flats, of brick, which Daniel J. Murphy will erect in Oak St., Newark. All will be fitted with modern improvements, except steam heat. The estimated cost of all is $60,000. These dwellings will be of pressed brick, with terra cotta trim and have copper cornices.

PITTSBURG, PA.—Janssen & Abbot, Archs., 223 Fourth Ave., have let general contract to A. & S. WILSON CO., 541 Third Ave., Pittsburg, for a 6-story building for the Young Women's Christian Association, to cost $300,000.

PHILADELPHIA, PA.—According to the Philadelphia "North American," within the next year the city will have twelve new fireproof school buildings, as $2,000,000 of the loan money, which has been turned over to the Board of Education will be expended on buildings, and $500,000 will be put into sites for new schoolhouses. Contracts for three new buildings, to be erected out of the loan money, have been awarded. During the next two weeks bids for four other buildings, to cost approximately $434,000, will be advertised. Plans have been completed for new schools at 59th and Race Sts., 23d and Cambria Sts. and in the 23d Ward. By the beginning of January contracts for these additional buildings will be awarded. Following is the list of schools which will be erected immediately out of the loan money: 19th and Butler Sts., 58th and Media Sts., 28th and Morris Sts., Twelfth and Wharton Sts., Benner and Ditman Sts., New Market and Green Sts., Boon's Dam, 59th and Race Sts., 23d and Cambria Sts., 23d Ward. Out of the 1909 appropriations for sites and buildings two new schools will be built, and during the course of the year old buildings will be repaired and wings added where congestion is greatest. In accordance with the agreement made with Councils, the Board of Education, at its recent meeting, put itself on record as agreeing to pay the sinking fund charges and interest on the school loan. William T. Tilden is Chn.

Bids are asked until 2.30 p. m., Nov. 27, by the Committee on Property, Bd. of Education, for the following named work: 30-division building at Twelfth and Wharton Sts., 26th Section; 24-division building, on the north side of Green St., between New Market and Hancock Sts.; wings to the Boons Dam School, 82d St. and Island Road, 40th Section; wing to the Henry W. Lawton School, Benner and Ditman Sts., 41st Section; storm sash at the Jesse George School, 63d and Hamilton Sts., 34th Section. William Dick is Secy.

Herman Miller, Arch., 1420 Chestnut St., has let contract to HORACE B. DEAL CO. for constructing a 1-story bank building for the Textile National Bank. Cost, $50,000.

WILKINSBURG, PA.—Bids are asked until noon, Nov. 21, by John M. Lindsay, Secy. School District, for erection of a high school in this borough. Thomas H. Scott, Machesney Bldg., Pittsburg, is Arch.

WILMINGTON, DEL.—The Board of Education approved of plans submitted by E. L. Rice, Arch., 815 Market St., Wilmington, for the alteration and enlarging of School No. 11, at Ninth and Scott Sts.

BALTIMORE, MD.—The Fidelity & Deposit Co. of Maryland will expend about $75,000 in enlarging and improving its building at Charles and Lexington Sts. Plans are being prepared by Baldwin & Pennington, Professional Bldg., Baltimore, providing for a 7-story addition, making entire building about 40 ft. wide.

WASHINGTON, D. C.—Bids were received as follows on Nov. 11 at the office of Bernard R. Green, Supt. of Construction of the National Museum Building, Washington, D. C., for furnishing "Breccia Stazzima" marble column shafts required for the screens in the rotunda of the new building: Batterson & Eisele, Times Bldg., New York, $27,829; A. Laube & Son, Long Island City, N. Y., $28,361; John Mueller, Jr., Cincinnati, Ohio, $37,500; Lautz Co., Buffalo, N. Y., $27,500; Evans Marble Co., Baltimore, Md., $21,000; R. C. Fisher Co., New York, $26,700; Wm. Bradley & Son, 90 West St., New York, $18,325.

Benjamin Schwartz, 920 F St., N. W., Washington, has purchased a site at 920 F St., N. W., including parts of lots in rear, on which to erect an L-shaped building, eight stories high. First floor to contain 5,564 sq. ft., to be used for tailoring purposes, and upper floors for offices. Cost, about $250,000.

The War Department will include in the estimates to Congress this year an item of $2,606,110 for barracks and quarters at coast artillery posts, according to the "Government Advertiser." The construction of suitable accommodations for officers and enlisted men has been seriously impeded by the lack of funds appropriated by Congress at the last session when only $1,987,260 was appropriated out of the required sum of $4,593,310. Most of this sum went to provide funds for barracks which are greatly needed. In the estimate, which is to be submitted, $93,600 will be devoted to barracks, $279,600 will be used for noncommissioned officers' quarters, $1,288,600 will be used for officers' quarters and $744,200 for other buildings.

CHARLOTTESVILLE, VA.—At the fall meeting of the Board of Visitors of the University of Virginia the site of the proposed law building, to be erected at a cost of about $70,000, was decided upon.

ATLANTA, GA.—E. P. Ansley and associates, 71 North Forsyth St., Atlanta, are having plans prepared by A. Ten Eyck Brown, 71 North Forsyth St., Atlanta, for erecting a proposed fire proof office building and theater. It will be nine stories high, 100 × 135 ft., reinforced concrete throughout, with steam heat, electric lighting, three electric elevators. Cost, $170,000. Contract will be awarded early in January.

*AMERICUS, GA.—Bids are asked until 3 p. m., Dec. 26, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, heating apparatus, electric conduits and wiring), of the U. S. post-office at Americus.

PALATKA, FLA.—R. Raymond Price, County Engr., Palatka, advises us that on Nov. 4, Putnam County voted to issue $35,000 of bonds for constructing a court-house.

PENSACOLA, FLA.—The SELDEN-BRECK CONSTRUCTION CO., Fullerton Bldg., St. Louis, Mo., general contractor for erection of $200,000 10-story American National Bank building, has let sub-contracts for brick and terra cotta work to ALLEN & CURRY, Chamberlain Bldg., Chattanooga, Tenn. About 1,000,000 bricks will be required.

ST. AUGUSTINE, FLA.—We are officially advised that Philip E. Robinson and M. J. Reidy, Associate Archs., National Bldg., Savanna, Ga., have prepared plans for a 2-story and basement brick school building, 75 × 212 ft., to be built at St. Augustine. Cost, $60,000. Material is being bought by the architects. The labor will be contracted for.

NEW ORLEANS, LA.—The city will erect a school to be known as the Beauregard School. It will be two stories high with basement and attic. Cost, $65,000. W. J. Hardee, City Engr., will supervise construction.

ALEXANDRIA, LA.—W. B. Turner, Mayor, advises us that contract will be let about Jan. 1 for erecting a city hall, 60 × 90 ft., to cost $60,000, including equipment. It will be constructed of brick and terra cotta, partly fireproof. Plans are being prepared by George R. Mann, Mann Bldg., Little Rock, Ark., Arch.

LAKE CHARLES, LA.—Bids are asked until 3 p. m., Dec. 28, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. post-office and court-house at Lake Charles.

COLUMBIA, TENN.—Contract for the construction of a post-office at Columbia, Tenn., awarded to GEO. MOORE & SONS, Nashville, Tenn., at $47,700, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C.

GALLATIN, TENN.—G. L. Lockhart, Stahlman Bldg., Nashville, Tenn., has prepared plans for a 3-story and basement hotel for S. J. Fletcher, Gallatin. Estimated cost, $40,000.

FRANKFORT, KY.—Bids will be received until Nov. 24 by the State Capitol Bldg., Comrs. at Frankfort, for the excavation, concrete, brick, prismatic light, drainage and cut stone work in connection with the architectural work of the terraces surrounding the new State Capitol. Plans and specifications may be seen at the office of F. M. Andrews & Co., Archs., 25 East Third St., Cincinnati, Ohio, or the Waldorf-Astoria Hotel, New York.

LOUISVILLE, KY.—R. T. Coleman, Louisville, Ky., purchased the property at the corner of Brook and Gray Sts. The property has a frontage of 105 ft. on Gray and runs back 200 ft. on Brook. It is the intention of Mr. Coleman to erect an apartment house to cost not less than $75,000.

CINCINNATI, OHIO.—The proposed building of the Ohio Mechanics' Institute, John L. Shearer, Principal, for which Samuel Hannaford & Sons, Archs., Hulbert Block, have been retained to prepare plans, will consist of a hall, with a seating capacity of 2,000, to be known as the Emery Auditorium; a special wing, 40 × 232 ft., five stories and basement, for shops. The remainder of the building will be used for laboratories, testing rooms, recitation rooms, library and exhibition rooms for industrial products. Architects will let contracts. It is the intention to have the building finished by the opening of school in 1910.

CLEVELAND, OHIO.—The plan of F. H. Haserot, Pres. Bd. of Education, for higher schools and an athletic field on East 107th St. near University Circle, has been adopted by the School Board. It provides for $592,000 for higher schools and $285,000 for elementary buildings.

COLUMBUS, OHIO.—Bids are asked by the Board of Trustees, the Ohio State University, until noon, Dec. 9, for the erection of the following buildings at the Ohio State University: A students' building in accordance with plans and specifications prepared by George H. Hills, of Toledo, Ohio; a veterinary clinic building in accordance with plans and specifications prepared by Richards, McCarty & Bulford, of Columbus, Ohio.

TOLEDO, OHIO.—William Veler has awarded the contract for erecting the proposed bank building at East Broadway and Starr Ave. to JULIUS COMTE.

GARY, IND.—J. E. Hammons & Son have been awarded the contract for the plans for a new city hall at Gary to cost $55,000. The building will be of brick with stone trimmings and three stories high. The corridors will be of tile and the floors of reinforced concrete. Bids will be in order as soon as plans are completed.

FRANKLIN, IND.—The School Board has let a contract to WINSHIP & SON, of Rushville, Ind., for the construction of a school building. Cost, $40,000.

*COLDWATER, MICH.—Bids are asked until 3 p. m., Dec. 22, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the post-office at Coldwater.

DETROIT, MICH.—George W. Graves, Arch., Cleveland Bldg., has prepared plans for a 3-story family hotel and club house to cost $60,000.

KANKAKEE, ILL.—The proposition to issue $150,000 of bonds for the purpose of building a court-house for Kankakee County has been carried. The complete cost of the structure will be in the neighborhood of $225,000.

NORTH CHICAGO, ILL.—The Bureau of Navigation, Navy Dept., Washington, has rejected all bids received on Nov. 4 for the construction of six officers' quarters and other buildings at the Naval Training Station, Great Lakes, North Chicago, Ill., as in excess of the appropriation. A list of bids was given last week.

CHICAGO, ILL.—Extensive alterations and improvements will soon be begun by the Lincoln Park Commissioners in that part of the park lying directly east of Center St. and back of the building of the Chicago Academy of Sciences. The most important improvement will be the erection of a refectory, to cost $60,000.

CHICAGO, ILL.—Plans are being considered by the Chicago, Burlington & Quincy R. R. Co. for the erection of a station and office building at Western Ave., to cost about $75,000. W. L. Breckinridge, Chicago, is Ch. Engr.

A 3-story building, which will cost $40,000, is to be put up by Dr. J. B. Loring, 103 State St., at the corner of Sheridan Road and Glengyle Pl., which he has just bought from Edward S. Judd. The lot is 100 × 150 ft.

CHICAGO, ILL.—According to the Chicago "Record-Herald," 44 schools, additions to schools and sites for schools are included in the plans adopted by the Buildings' and Grounds Committee of the Board of Education. The sites, schools and additions will, with the concurrence of the Board of Education, be provided in the following order, based upon locations where the greatest need exists: Jefferson—12-room building, with assembly room and gymnasium to the west of the present school. Garfield—12-room addition, with assembly room and gymnasium. Noble—24-room building, with assembly hall and gymnasium, at North 42d Ave. and Hirsch St. McLaren—0-room addition west of the present building on ground already owned by the School Board. Clarke—Replace middle section of present building with 18 new rooms. 24-room building at 61st, Wood and Honore Sts. March—12-room building at 98th, Escanaba and Exchange Aves. Raster—12-room addition. Gallistel—9-room addition. Has 400 pupils too many. Fulton—12-room addition. 24-room building at 13th and Lawndale. 24-room building at Hamlin and Humboldt Aves. 24-room building at Albany Ave. and Byron St. Irving—9-room addition.

New Buildings planned.—24-room building at Campbell and Wilson Aves. 24-room building at 51st and Byron Sts. Park Manor—New site and building at 71st and South Park Aves. Gladstone—Site and 6-room addition east of present school. John Marshall High—Addition to accommodate commercial classes. Farragut—Addition to accommodate high school pupils of first and second years. Combination high and elementary school at Ardmore and Southport Aves. Curtis High School—Secure site facing Palmer Park. Commercial High School—At some central point accessible from all parts of the city. South Side Technical School—To be erected at 62d St. and Jackson Park Ave. Hyde Park High School—New building at new site. Shields—Two 6-room wings added to present building. 12-room building at 51st St. and Artesian Ave. Howe—12-room addition. Agassiz—26-room [illegible] ing on new site, ding with a 15-Parkman—Replace west- room building. room addition. Corker- Burke—26-room Holmes—9-room additi- building. Moseley—20-room build- resent building, ent unsatisfactory bui- replace pres- six rooms to present u- Burnside—Add pleted building. Carter—12-room addition present building, 8-room building at 103- and Michigan Ave. Earle—12-room s to 14-room building at Polk St. and ndale Ave. 24-room building at Sacr to and Bertan Sts. Field—24-room buil- on some site in Rogers Park. Keith—Ad- sembly hall and gymnasium. Fiske—Addi to north of present building. Ole horp—Complete new building near prese

MADISON, WIS.—Bids asked by Lew F. Porter, Secy. Wiscon- Capitol Comm. until noon, Dec. 18, fo- rnishing and erecting the steel work e south wing and central portion of the Capitol now building. George B. Post & ons are Archs. 347 Fifth Ave., New York

MINNEAPOLIS, MINN. H. Hewitt, 18 North Fourth St., has pre- d plans for a 2-story church for the St rks Episcopal congregation, Rev. C. E. H Rector. Cost, $150,000.

ST. PAUL, MINN.—Herm Kretz, Arch., New York Life Bldg., St. P has awarded the contract for the who le office and warehouse building for the P. J. Bowlin Liquor Co., to be built on Fifth St. near Robert St., to F. J. ROM & SON, 209 Ramsey St., city. It will be four story high, of Turner reinforced concrete fireproof construction, having steam heating and electric lighting. Cost, $90,000.

Buechner & Orth, Archs., Manhattan Bldg., city, are preparing plans for the construction of a 4-story pressed brick and cut stone store and office building to be constructed at Fifth, Seventh and Exchange Sts. It is being built by E. Albrecht, and will have steam heating, electric lighting, marble and tile work. Cost, $50,000.

*ALEXANDRIA, MINN.—Bids are asked until 3 p. m., Dec. 23, by James Knox Taylor, Superv. Arch., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. post-office at Alexandria.

CROOKSTON, MINN.—Bids were received as follows Nov. 17, at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Crookston, Minn.: Northern Construction & Engineering Co., Grand Forks, N. Dak., $63,250; Northern Construction Co., Milwaukee, Wis., $64,634; General Construction Co., Milwaukee, Wis., $72,370; J. W. Miller, St. Paul, Minn., $66,116; Ole M. Siverson, Crookston, Minn., $68,400.

IOLA, KAN.—Bids were received as follows Nov. 16 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Iola, Kan.: Dieter & Wenzel Construction Co., Wichita, Kan., $50,559; North-Western Construction Co., Wahpeton, N. Dak., $54,997; Carl A. Nilson, Kansas City, Mo., $53,870; Frank K. Latimer, Kansas City, Mo., $53,842; J. A. Daly, Nevada, Mo., $50,571; Joseph H. Stone, Kansas City, Mo., $52,656; Wurster Construction Co., Wichita, Kan., $50,750; Parsons & Kline, Omaha, Neb., $52,332.

ROSEDALE, (Kansas City post-office), KAN.—Wessbecher & Hillebrand, Archs., 19 South Broadway, St. Louis, have prepared plans for a church for the Roman Catholic congregation, Rev. Dorseifer, Rector, Rosedale. Cost, $45,000.

WINFIELD, KAN.—The Southwest Kansas Conference College, 323 Seward St., has let general contract to H. EILENBERGER & CO., Kansas City, Mo., at $61,859, for erecting a 3-story stone college building. L. E. Simes is Secy.; Malcolm S. Martin, Arch., Hannibal, Mo.

BUTTE, MONT.—Link & Haire, Archs., Silver Bow Block, Butte, are preparing plans for a 4-story court-house for Silver Bow County, Butte. Estimated cost, $1,000,000.

ST. JOSEPH, MO.—Press reports state that the SELDEN-BRECK CONSTRUCTION CO., Fullerton Bldg., St. Louis, Mo., has been awarded the contract for the erection of the Wheeler & Motter Mercantile Co.'s building on Fourth St., to cost approximately $130,000. There were seven other bidders. Eckel & Boschen, Commercial Bank Bldg., St. Joseph, are Archs.

KANSAS CITY, MO.—Edwards & Sunderland, Archs., Sheidley Bldg., are preparing plans for an 8-story hotel for J. I. Adcock, to cost $140,000.

JEFFERSON BARRACKS, MO.—Bids are asked until 11 a. m., Nov. 20, by Capt. O. W. Bell, Q. M., for constructing a double set of Hospital Corps sergeants' quarters, including plumbing, electric wiring and lighting fixtures.

LITTLE ROCK, ARK.—The State National Bank Building Co. has secured 99-year lease on a site at Fifth and Main Sts., on which to erect a bank and office building. The structure will be seven stories, with basement and sub-basement; 50 × 140 ft.; 142 ft. high. Cost, $250,000. George R. Mann, Mann Bldg., Little Rock, is Arch.

The Terminal Hotel Co. let contract to G. W. FAIR for a hotel and business building to cost $40,000.

FORT WORTH, TEX.—The plans of Sanguinett & Staats, Archs., F. [illegible]. M. Bank Bldg., have been accepted for remodeling and reconstructing the Delaware Hotel for the J. T. W. Tillar estate. B. J. C. Tillar, Executor. The work will cost about $500,000.

OKLAHOMA, OKLA.—Jordan & Ellsworth have awarded contract to the CROSS CONSTRUCTION CO., Oklahoma City, for erection of theater and office building combined. It will have three stories and basement; fireproof, 50 × 140 ft. Walls will be of fireproof brick laid in cement; girders of structural steel; floors of cement. Electric wiring will run through conduits. Estimated cost, $75,000.

CHICKASHA, OKLA.—Hair & Smith, of Salina, Kan., have prepared plans for a 3-story city hall, 63 × 50 ft., for the City of Chickasha. It will be constructed of press brick and Carthage stone, with iron and steel work, concrete flooring, patent roofing, tiling, hard plaster, gas and electric fixtures, plate glass, water closets, lavatories, steam heat.

HARTSHORNE, OKLA.—Bids are asked by W. E. Hastings, Clerk Bd. of Education, until 7 p. m., Nov. 25, for the erection and construction of a 10-room brick school building.

COLORADO SPRINGS, COLO.—Shepley, Rutan & Coolidge, Archs., Borland Block, Chicago, have let general contract to WHITNEY-BROWN-GREEN CO., of Denver, Colo., for a building and office building for the Exchange National Bank, Colorado Springs. Cost, $[illegible].

SPOKANE, WASH.—A building permit has been issued by the Board of Public Works for the proposed Children's Home, which is to cost $[illegible].

Edward Johnson will erect a 4-story office building to cost about $45,000 on the property which he purchased recently on East Sprague St.

The Spokane Trust Co. has leased from the Odd Fellows property at the corner of Main Ave. and Waverly St. for a term of 25 years, upon which they will erect an office building to cost about $150,000.

W. H. Linney will build a 3-story building on the lots he owns at the corner of Riverside Ave. and Division St. The building will cost about $50,000. If the building is arranged for a hotel it will cost about $75,000.

Jesse D. Newman and W. W. Dreyfoos will build a 3-story hotel on the south side of Main Ave. between Browne and Division Sts. The building will occupy the entire lot, which is 50 × 142 ft., and will cost about $40,000. Work is to be started March 1.

SPOKANE, WASH.—J. D. Sherwood, owner of the Sherwood Block on the north side of Riverside Ave., between Stevens and Howard Sts., announces that an 8 or 10-story office building will be erected on the property, to cost from $200,000 to $250,000.

SPOKANE, WASH.—Robert E. Strahorn, Pres. of the North Coast Ry. Co., which has expended more than $12,000,000 on terminal, right-of-way, engineering and other features in Spokane, Wash., announces that a terminal building, to cost $2,000,000, will be erected in this city. The structure is to occupy two blocks, taking in the present site of the city hall and other buildings in Front Ave. Entry to the city is to be by way of a four-track trestle under the span of the Monroe St. bridge, at the foot of Spokane Falls, thus placing the entire set of tracks 18 ft. below the present street grade.

SEATTLE, WASH.—Bids are asked by James Knox Taylor, Supervising Archt., Treasury Dept., Washington, D. C., until 3 p. m., Dec. 21, for the construction of the U. S. Government buildings at the Alaska-Yukon-Pacific Exposition at Seattle.

The Weiler Investment Co. has obtained a permit to build a 3-story brick building, 120 × 120 ft., costing $50,000, at 511-523 Seventh Ave., South.

The Metropolitan Building Co. has taken out a permit for the construction of a $450,000 building on Fourth Ave., between Union and University Sts. The contract for the excavating has been let to McDERMOTT & DRISCOLL. The building will have a steel frame, reinforced with concrete. The exterior walls will be of pressed brick, with terra cotta trimmings.

SACRAMENTO, CAL.—Bids were received as follows Nov. 5 by the Board of Supervisors for erecting a jail: C. J. Matthews, $162,820; Clark & Henery, $164,995; Pacific Construction Co., $161,827; Rickon Ehrhardt Engineering & Construction Co., $165,000; W. N. Concannon & Co., $179,300; Kopp Bros., $168,000; Healy, Tibbetts Co., $187,200; Western Bridge & Construction Co., $179,222; W. F. Hanrahan, $169,989; P. J. Lynch, $198,000; Cotton Bros. & Co., $174,820; Burrell Bridge & Construction Co., $173,900.

SANTA ROSA, CAL.—James Knox Taylor, Supervising Archt., Treasury Dept., Washington, D. C., has awarded to HOYT BROS., Santa Rosa, Cal., contract for the construction of a post-office building at Santa Rosa, Cal., at $55,750. Time, Dec. 1, 1909.

SAN FRANCISCO, CAL.—Excavating the lot leased from the city by W. H. Mack has been started preparatory to the erection of a building on the land. The lot is situated on the north side of Post St., between Grant Ave. and Stockton St., and has a frontage of 70 ft. on Post St. and a depth of 122 ft. Construction will begin immediately, as the working plans are finished and contracts are being let on the building, which is to cost at least $50,000. The building will have an ornamental front and will be three stories in height.

SAN FRANCISCO, CAL.—During the month of January, contracts will be let for the construction of the new City and County Hospital, which it is estimated will cost $2,600,000. Preliminary plans have been prepared by Newton Tharp, City Arch., and have been given the approval of the Health Board. The City Architect has been instructed to proceed at once with the preparation of the working plans for the group of buildings which will go to make up the new City and County Hospital, which is to be built on the site of the old hospital, Potrero Ave., between 22d and 24th Sts. Additional property is being secured for the site and in designing the buildings the needs of the city for the next hundred years have been considered. All the buildings are to be of the type generally known as Class A, that is, steel frames with natural or artificial stone and brick finishings. Provision is made that additional ward buildings may be added from time to time as they are needed. The main or administration building is to face Potrero Ave. and will be three stories in height. It will be flanked on either side by two ward buildings, thus giving accommodations for more than 400 patients. The central building will be connected with the ward buildings by corridors. The ward buildings are to be four stories in height. On the northern corner of the Potrero Ave. frontage will be located a 2-story building which will be used jointly as an emergency hospital and a general operating room. On the southern extremity of the Potrero Ave. frontage will be located the nurses' home, which is to be a 2-story building. Immediately in the rear of the administration building will be located the power-house which will furnish light, heat and power for the entire group of buildings. Flanking the power-house on the south is to be the morgue building, and on the north will be located the stables. Toward the rear of the site on slightly elevated ground will be located two groups of buildings—one set for the housing of patients suffering from tuberculosis and the other to be used by patients suffering from infectious or contagious diseases.

Newton Tharp, City Arch., has been directed by the Board of Education to prepare plans and specifications for the Commercial school, to be erected in Grove St., near Polk. The cost of the building is estimated at $190,000. It will contain 22 rooms.

The plans and specifications for the Mission grammar school have been approved by the Board of Education. The matter has been referred to the Board of Supervisors and bids for the work will be advertised for within a few weeks.

COEUR D'ALENE, IDAHO.—According to the preparations being made by Rev. Thomas J. Purcell, construction work on the proposed Roman Catholic church will commence early in the spring. It is estimated the cost will be about $45,000. It will have a seating capacity of 1,000 people.

TORONTO, ONT.—Plans have been prepared by Darling & Parson, Archs., Imperial Bank Bldg., for the proposed parish house for St. James Cathedral. Estimated cost, $60,000.

TORONTO, ONT.—The British Canadian Departmental Stores, Ltd., of London, have decided to purchase the Knox College property on Spadina Ave., and they will erect a department store on the property. The capital of the company is $3,000,000. The building to be erected will be twelve stories high and will occupy the entire circle. It will be of skeleton steel construction and will cost about $700,000.

WATER SUPPLY—IRRIGATION.

(denotes that this work is advertised in Engineering News.)*

WATERBURY, CONN.—The Board of Public Works has recommended that an appropriation of $9,000 be included in the estimates of January, 1909, for the water main in Baldwin St. R. A. Cairns is City Engr.

NEW YORK, N. Y.—The Board of Aldermen on Nov. 10 appropriated $1,800,000 for the installation of a highpressure water system in the district bounded by Houston St., East River, Bowery and James St. John H. O'Brien is Comr. Water Supply, Gas and Electricity.

*NEW YORK, N. Y.—Bids were opened on Nov. 17 by the Board of Water Supply for test borings in connection with the Hill View distribution reservoir, which ultimately will furnish 100,000,000 gallons of water a day to the Boroughs of Brooklyn and Richmond. The bids ranged from $105,678 by the Snare & Triest Co., 143 Liberty St., New York, to $230,300. No award has been made.

AMSTERDAM, N. Y.—Bids will be received by the Board of Water Commissioners, Chas. C. Yund, Pres., until Nov. 24 for c.-i. pipe and castings for Hanns Creek Conduit No. 2. James R. Snell, Supt. W.-Wks. Advertised last week.

*HADDONFIELD, N. J.—Bids are asked by J. Morris Roberts, Mayor, and the Borough Council until 8 p. m., Dec. 1, for the construction of the municipal water-works, the work including about eleven miles of c.-i. or other approved pipe, special castings, valves and fire hydrants, power-house and foundations, stand pipe, 25-ft. diameter by 110 ft. high, laying all pipe lines, two 1,000,000-gallon pumping units, steam, gas producer or gasoline, and two or more artesian wells. Allen Clymer is Boro. Clk.

PITTSBURG, PA.—Bids will be received until Nov. 23 by the City Controller for cleaning the interior surface of about 1,960 lin. ft. of 8-in. c.-i. water main and about 8,400 lin. ft. of 6-in. water main in its present position. George W. Guthrie is Mayor.

LEBANON, PA.—The Water Board has reported favorably the bill appropriating $22,000 for the enlargement of Dam No. 2 at South Mountain.

ALLENTOWN, PA.—A reservoir will be constructed at once on the Black Creek about two miles south of the Blackwood colliery in Schuylkill County.

ASHLAND, PA.—The Town Council has decided upon the construction of a reservoir with a capacity of 6,000,000 gallons.

BALTIMORE, MD.—Work will probably start about July 1 on the proposed new water supply system in Gunpowder Valley, for which the citizens on Nov. 3 voted to issue $5,000,000 bonds. The proposed reservoir will have a capacity of 21,000,000,000 gallons. Alfred Quick is Ch. Engr., Water Dept. Noted on Nov. 12.

PARSONS W. VA.—The citizens have voted in favor of issuing $30,000 of bonds for the construction of a water-works and sewerage system.

HAMLET, N. C.—The Hamlet Water-Works Co. will extend the water mains and enlarge and improve plant.

ADAIRSVILLE, GA.—The city has decided to lay about 3,000 ft. of 6-in. c.-i. water mains.

COVINGTON, GA.—Bids will be received by C. C. Brooks, Chn. Bd. Comrs., until Dec. 2 for construction of water-works, to include 400 tons of 6 to 10-in. c.-i. pipe, valves, hydrants, one 15 × 110-ft. stand-pipe, two compound pumping engines, one turbine pump and motor, brick pumping station, settling basin and clear water basin; and a sewerage system, to embrace five miles of vitrified clay pipe sewers, 6 to 15 ins., with manholes, flush tanks, etc. J. B. McCrary & Co., Empire Bldg., Atlanta, Ga., are Engrs.

MERIDIAN, MISS.—We are officially advised that the date for receiving bids for furnishing and erecting a 5,000,000-gallon horizontal cross-compound and fly-wheel pumping engine, and for furnishing all tools and material and constructing reinforced-concrete reservoir has been extended from Nov. 24 to Dec. 8. W. F. Wilcox is Engr.

CLARKSDALE, MISS.—The city has awarded the contract for boring an artesian well to JOHNSON & FLEMING, of Memphis, Tenn., to increase the water supply of the town. The contract is made under a guarantee of 150 gallons per min. W. W. Purnell is City Clk.

NEWPORT, KY.—The citizens on Nov. 3 voted for water-works improvements to include the construction of a standpipe, etc. W. L. Glasier is Supt. W.-Wks.

TOLEDO, OHIO.—The contract for the construction of the filtration plant was awarded on Nov. 13 by the Board of Public Service to the A. BENTLEY & SONS CO., River Road, Toledo, at $41,358. Other bidders were: Henry J. Spieker, of Toledo, $44,492; C. H. Faths & Sons, of Cleveland, $49,618; Falkelan Electric Construction Co., of Chicago, Ill., $60,584; M. Rabbitt Sons Co., of Toledo, $61,864. Frank I. Consaul is City Engr.

CARSONVILLE, MICH.—The citizens on Nov. 3 voted to issue $5,000 of bonds for the construction of water-works.

DETROIT, MICH.—The Board of Water Commissioners on Nov. 10 rejected all bids for approximately 3,650 tons of c.-i. water pipe, ranging in size from 6in. to 24-in.; also for 788 water-gate valves, ranging in size from 4-in to 48-in., and for 300 testing boxes, ranging in size from 6-in. to 12-in.

CHICAGO, ILL.—Bids will be received until Nov. 23 by the Cook County Commissioners at the office of William McLaren, Supt. Pub. Ser., Cook County Court-House, Chicago, for the water supply and fire protection and sewers and sewage disposal of the new Cook County Infirmary to be erected in Oak Forest, 18 miles from Chicago. Holabird & Roche, Archs., Monadnock Bldg. Bids on water and sewers are to be stated separately.

PEKIN, ILL.—Plans and specifications for water-tube boilers, compound-condensing steam engines and centrifugal pumps for pumping plant on Illinois River about 17 miles south of Pekin, are on file at the office of Engineering News, New York. Bids are asked until Nov. 24. The Harman Engineering Co., 120 Fredonia Ave., Peoria, Engrs.

WEST ALLIS, WIS.—The contract for laying 6,000 ft. of 6 and 8-in. water mains here has been awarded to GEORGE ZIMMERMAN, of Milwaukee, Wis.

WILTON, WIS.—Bids are asked until 8 p. m., Dec. 1, for the construction of a complete water-works system. The work will comprise, approximately, a distribution pipe line system; a reinforced-concrete or masonry reservoir, 60,000 and 85,000 gallons capacity; a 10-HP. deep well geared base gasoline engine; a brick building 16 ft. × 18 ft. and 8-in. well 100 ft. deep. Oscar Claussen is Consult. Engr., German-American Bank Bldg., St. Paul, Minn.

ST. MARYS, KAN.—We are officially advised that bids were received as follows on Nov. 10 by the city for constructing a water-works and electric lighting plant here: Frank A. Huribut, Kansas City, Mo., $29,212; Joplin Electric & Construction Co., Joplin, Mo., $26,040; W. W. COOK & SON, Junction City, Kan., $22,760 (awarded contract); Squire Electrical Co., Kansas City, Mo., $23,628; George M. King Construction Co., Des Moines, Iowa, $38,090; Lund & Cunyan, Blackwell, Okla., $23,685; Matthews Electrical Construction Co., Kansas City, Mo., $23,335.

W. W. COOK & SON also secured the contract for furnishing hydrants and valves, c.-i. pipe and special castings, at $8,578; pumping machinery, high speed 125-HP. engine and tower and tank, 70,000 gallons.

All bids for electrical and arc-lighting equipment were rejected. Burns & McDonnell, Scarrit Bldg., Kansas City, are Engrs.

CHEYENNE, WYO.—Bids will be received until Nov. 30 by the city for the construction of a masonry dam to contain approximately 7,500 cu. yds. of concrete, 3,847 cu. yds. earth fill and 348 cu. yds. stone rip rap; also 547 cu. yds. of loose rock and 1,643 cu. yds. of solid rock removed. C. C. Carlisle is City Engr.

The citizens on Nov. 3 voted to issue $500,000 of bonds to begin the construction on the $1,000,000 gravity water supply system. All pipe to be used will be c.-i. pipe and the lines will be approximately 40 miles long.

KANSAS CITY, MO.—The pumping capacity of the Turkey Creek pumping station will be increased by the installation of an 18,000,000-gallon pump. The Fire and Water Board on Nov. 5 authorized W. G. Goodwin, Engr., to prepare plans and specifications for the pump. Estimated cost, $115,000.

*KANSAS CITY, MO.—Flanagan Bros., Second St. and Lydia Ave., Kansas City, submitted the lowest bid to the Board of Fire and Water Commissioners on Nov. 10 for the construction of a settling basin at the Quindaro pumping station at $65,983 for earth basin and $98,228 for concrete basin. J. L. Darnell is City Engr.

CARL JUNCTION, MO.—The Michel-Cook Engineering & Construction Co., of Joplin, Mo., are preparing plans for the construction of water-works. Estimated cost, about $20,000.

*GREENVILLE, TEX.—Bids are asked until noon, Dec. 1, by the city for furnishing and delivering f. o. b. Greenville, the following c.-i. pipe, valves and specials. The quantities are approximate only, and the city reserves the right to increase or decrease the following quantities, as it may see fit: 500 ft. standard 16-in., 27,300 ft. standard 6-in., 2,700 ft. standard 8-in. c.-i. pipe, 65 2-way hydrants, 2½ ft. Bury., 4 8-in. gate valves, 21 6-in. gate valves, 25 extension gate boxes, 20 tons specials. J. W. Maxcy Co. are Engrs.-in-Charge, Binz Bldg., Houston, Tex.

ANADARKO, OKLA.—The city has awarded the contract to the O'NEIL ENGINEERING CO., Dallas, Tex., for constructing a dam on the Washita River and install water power, extend light, water and sewer systems and other improvements at about $85,000. J. C. Stelzner is Mayor.

BOULDER, COLO.—A plat and statement was filed on Nov. 6 with the County Clerk for the McCaslin reservoir, which will be located in Gifford gulch, a tributary to the St. Vrain River, and will impound 2,379,603 cu. ft. of water. The dam will be 28 ft. high. Estimated cost, $18,000.

GREELEY, COLO.—The contract for the construction of the Henrylyn irrigation system, consisting of 90 miles of ditch and various reservoirs, the latter having a capacity of 80,000 acre ft., was let on Nov. 11 by the Henrylyn Irrigation District to the PARKER-WASHINGTON CONSTRUCTION CO., 4500 Duncan St., St. Louis for $3,000,000. Work on the project will begin within six weeks. The water will be brought over the mountains by a tunnel from Williams Creek, carried into Clear Creek, then into the South Platte River and down the Denver & Hudson Canal to the land. The constant flow from Williams Creek and from seepage and flood waters, as well as from Clear Creek and the South Platte, will increase the reservoir supply to 200,000 acre ft.

RENTON, WASH.—The citizens have voted in favor of issuing $23,000 of bonds for the construction of a new water system.

SUNNYSIDE, WASH.—The following contracts have been awarded in connection with the Mabton Lateral Sunnyside irrigation project: To H. W. HOLDEN, Portland, Ore., Schedule 1, involving the excavation of 28,000 cu. yds. of material, at $4,382; Schedules 2 and 3 to DAVID S. WILSON, of Mabton, involving the excavation of 31,500 cu. yds. of material, at $5,918; to GEO. C. CLARK, Richland, Wash., Schedule 4, consisting of 2,100 lin. ft. of timber flumes, requiring 170,000 ft. of lumber, $5,040.

GRANTS PASS, ORE.—The Josephine County Irrigating & Power Co. is being organized by H. L. Gilkey, First National Bank, Grants Pass; John Christie, G. H. Garner, E. E. Blanchard, O. S. Blanchard, R. Thomas and George A. Hamilton, to irrigate lands belonging to incorporators in Josephine County. An engineer will be employed to examine sources of water and lay out ditches, make preliminary survey, etc. It is proposed to furnish water to arid lands around Grants Pass.

WOOD RIVER, ORE.—F. H. WHEELER has secured the contract for constructing the water-works and electric light plant, at $19,550.

*GRIDLEY, CAL.—Bids will be received by the Clerk of the Board of Trustees until noon, Dec. 14, for furnishing material, making, erecting and constructing a steel tank and tower for water-works. Specifications are on file at the office of Engineering News, New York.

POCATELLO, IDAHO.—OSCAR SONNERNKALB, of this city, and FRED. W. MITCHELL, have been awarded the contract for surveying the Twin Falls-Bruneau Carey act irrigation project, at $7,113.

BOISE, IDAHO.—The Secretary of the Interior has ordered the suspension of the contract of Page and Brinton, of Boise, Idaho, for Schedules 2 and 3 on the main canal, Payette-Boise project. On Oct. 5 the contractors were notified that unless within five days from that time they had resumed work on their contract, with force sufficient to complete the work by Dec. 1, the contract would be suspended. The Government has taken over the equipment of the contractors and will proceed at once to complete the work by force account.

KINGSTON, ONT.—Bids are asked by E. F. Jarvis, Secy. Dept. Militia and Defense, until noon, Nov. 25, for the installation of a water supply at the Royal Military College here.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

DEPOSIT, N. Y.—The construction of a sewerage system and sewage disposal plant is under consideration. Calvin Onderdonk, Village Clk., desires to correspond with an engineer with regard to making preliminary surveys, plans and estimates.

BUFFALO, N. Y.—Bids will be received until Nov. 25 by Francis G. Ward, Comr. Pub. Wks., for constructing a 10 and 12-in. tile sewer in a portion of Cambridge Ave.

SYRACUSE, N. Y.—CHARLES T. HOOKWAY has been awarded the contract at $3,851, for constructing a pipe sewer here, and JOSEPH SWIFT, at $4,003, for constructing a pipe sewer in Avery Ave., Bryant St. and Whittier Ave.

NEW YORK, N. Y.—Bids were received as follows on Nov. 9 by Louis F. Haffen, Pres. Boro. of The Bronx for (a) constructing a sewer and appurtenances in Nelson Ave., between Boscobel Ave. and Featherbed Lane; (b) constructing sewers and appurtenances in East 173d St., between Hoe Ave. and Bryant Ave., and in Bryant Ave., between East 173d St. and the summit southerly therefrom; (c) constructing sewers and appurtenances in East 187th St., between Webster Ave. and Park Ave. West, and in Park Ave. West, between East 183d and East 189th (Welch St.): John Farrell, (a) $7,807; D. W. Moran, 562 Burnside Ave., (a) $9,361; George H. Dunn, 481 East 171st St., (a) $8,572; (b) $6,744; (c) $11,054. P. F. Brennan, 244 Mount Hope Pl., (a) $17,786; (b) $6,908; (c) $13,226. Stanton Contracting Co., (a) $8,806; Haggerty Contracting Co., 217 West 125th St., (a) $10,010; (b) $8,978; (c) $12,438. Briggs & McLaughlin, (a) $9,526; (b) $9,088; (c) $22,715. J. S.

Rogers, (a) $10,436; (b) $9,227; (c) $11,382. Hanover Contracting Co., 215 West 125th St., (a) $8,382; (b) $8,155; (c) $10,948. J. C. Voorhees, (a) $9,296; (b) $8,304. The Wilton Contracting Co., (a) $9,427. J. H. Karrigan, (b) $9,804. Joseph Burns, (b) $9,001. J. J. Maiduvan, (b) $11,306. O'Leary & Flannigan 245 East 202d St., (c) $9,445. John Lyons, (c) $11,297.

NEW YORK, N. Y.—Bids are asked by the Board of Health until 10 a. m., Dec. 2, for furnishing all the labor and materials necessary or required to construct an iron and tile trunk sewer and branch tile sewers throughout the grounds of the Riverside Hospital, North Brother Island, City of New York. Thomas Darlington, M. D., is Pres.

Bids are asked until 11 a. m., Dec. 1 by Louis F. Haffen, Pres. Boro. of The Bronx, for constructing sewers and receiving basins in various streets.

*NEW YORK, N. Y.—There will be a public hearing by the New York Harbor Line Board at 10 a. m., Dec. 9, at 39 Whitehall St., New York, on application to Passaic Valley Sewerage Commission for consent of War Department to construct and maintain an outlet sewer beneath the waters of New York and Newark Bays. Parties interested are invited to attend. Col. D. W. Lockwood, Corps Engrs., U. S. A., is Senior Member.

NEW BRIGHTON (S. I.), N. Y.—Bids were received as follows on Nov. 10 by George Cromwell, Pres. Boro. of Richmond, for furnishing all the labor and materials required for constructing a separate storm water outfall sewer from the bulkhead at the foot of Canal St., westerly through Canal St. to the west side of Bay St., etc., all being within sewage district No. 3A in the Second Ward, together with all work incidental thereto: Gore-Meenan Co., 206 Broadway, New York, $29,893; Thos. Crimmins Contracting Co., 16 East 47th St., $57,903; Murphy Bros., $53,046; W. J. Quinlan, $45,939; Joseph Johnson's Sons, West New Brighton, $39,178; John E. Donovan, $50,384; Bonnaci & Vencelli, $55,330; McHarg, Barton Co., 165 Broadway, New York, $40,793.

BROOKLYN, N. Y.—Bids are asked by Bird S. Coler, Boro. Pres., until 11 a. m., Nov. 25, for constructing sewers and sewer basins in various streets.

ELIZABETH, N. J.—We are officially advised that bids were received as follows on Nov. 2 by the city for the construction of an intercepting sewer of brick (Parmley block), here: Joseph Puglia, $147,096. The Harrison Construction Co., 837 Broad St., Newark, N. J., $180,714. A. E. Sanford Co., Hoboken, N. J., $177,168. Wade & Callahan, $174,523. William J. McCloud & Co., 114 Broad St., Elizabeth, $171,297. Thomas H. Riddle, New Brunswick, N. J., $180,126. Gore-Meenan Co., $128,520 (rejected as bond was defective). W. H. Luster, Jr., is City Surv. Itemized list of bids are given in this issue under Contract Prices.

TRENTON, N. J.—Bids will be received until 8 p. m., Dec. 1, by Harry B. Salter, City Clk., for constructing a sewer in a portion of Taylor Alley and a portion of Christoph Ave.

BALTIMORE, MD.—The Sewerage Commission plans to expend $100,000 annually for constructing storm-water drains until 1914, when it is expected that entire system will be about completed. Calvin W. Hendrick is Ch. Engr. Comn.

*WASHINGTON, D. C.—Bids will be received until noon, Nov. 30, by the Commissioners of the District of Columbia for constructing a concrete sewer.

*WASHINGTON, D. C.—Bids were received as follows on Nov. 16 at the office of the Commissioners of the District of Columbia, for the construction of sewers in the District: (a) Warren F. Brenizer Co., (b) E. G. Gummel, (c) John E. Lyous, (d) George Hyman, (e) R. J. Beall Construction Co., (f) James A. Coyle, all of Washington, D. C. East Side intercepting sewer, Section D., from Boundary to Brookland: Excavation, (a) 70 cts., (b) $1, (c) 85 cts.; sewer brick masonry, (a) $15, (b) $16, (c) $15; embankment, (a) 30 cts., (b) 40 cts., (c) 45 cts.; invert brick masonry, (a) $21, (b) $20, (c) $20; concrete masonry "D," (a) $8.25, (b) $8.50, (c) $9. Franklin St., between Queen's Chapel Road and 24th St.: Excavation, (d) 80 cts, (a) 90 cts., (c) $1.50; sewer brick masonry, (a) $15, (b) $16, (c) $22.25; 15-in. diameter pipe, (a) 85 cts., (b) $1, (d) $1.02; 12-in. pipe, (a) 70 cts., (b) 90 cts., (d) 93 cts.; 10-in. pipe, (a) 63 cts., (b) 80 cts., (d) 84 cts. Conduit Road: Excavation, (a) 63 cts., (b) 80 cts., (d) 90 cts., (c) 88 cts., (f) 75 cts; sewer brick masonry, (a) $14, (b) $14, (d) $22.25, (e) $13, (f) $14; 24-in. diameter pipe, (a) $1.12, (b) $1.15, (d) $1.34, (e) $1.25, (f) $1.19; 21-in. pipe, (a) $1, (b) $1.05, (d) $1.18, (e) $1.20, (f) $1.09; 18-in. pipe, (a) 89 cts., (b) 95 cts., (d) $1.12, (e) $1.15, (f) 99 cts. Rock Creek Church Road: Excavation, (a) 85 cts., (b) $1.20, (e) 93 cts.; sewer brick masonry, (a) $16, (b) $14, (c) $13.50; vitrified brick masonry, (a) $22, (b) $21, (e) $21; concrete masonry "B," (a) $9, (b) $9, (c) $9.40; concrete masonry "C," (a) $9, (b) $9, (c) $8.90; invert blocks laid, (a) 65 cts., (b) $1, (e) $1; 6-in. pipe, (a) 30 cts., (b) 40 cts., (c) 30 cts.

PARSONS, W. VA.—See item under Water Supply—Irrigation.

COVINGTON, GA.—See item under Water Supply—Irrigation.

SELMA, ALA.—The city has awarded the contract to the CROCKETT PAVING CO., Birmingham, Ala., for the construction of sanitary sewer, 2¼ miles long in North Selma, the main sewer to be of 12-in. pipe. Julien Smith, City Engr.

FRANKLIN, KY.—The citizens have voted $20,000 of bonds for the construction of a sewer system.

LEXINGTON, KY.—The citizens on Nov. 3 voted to issue $25,000 of bonds for the construction of sewers here. John Skain is Mayor.

LOUISVILLE, KY.—The city has transferred the contract for the construction of a sewer in Green St., from Garden to Shelby St., recently awarded to Herr & Raftus, Dorchester, Mass., to SCHULTZ & VOGT CO., of Louisville. Cost about $7,000.

AKRON, OHIO.—Bids will be received until Nov. 23 by the Board of Public Service, Ray F. Hamlin, Secy., for constructing sewers in portions of Haynes, Snyder and Vesper Sts. and Ira Ave., and certain other sewers.

ALLIANCE, OHIO.—The State Board of Health has notified this city that plans must be prepared at once for the construction of a sewage disposal system, as sewage cannot be emptied into the local rivers after one year. Plans for the plant, which will cost about $75,000, will be prepared at once. The plant will be of the filtration and sedimentation class, and will be constructed entirely of concrete. Actual work will not be started before next summer.

GALION, OHIO.—H. J. Glover, Lorain, Ohio, has been awarded the contract at $22,026 for constructing about three miles of trunk line sewer here. List of bidders noted on Oct. 20.

*WYOMING, OHIO.—THOMAS P. STRACK was awarded the contract on Nov. 10 by the village for the construction of a sewage disposal plant and about 22,569 ft. of sanitary sewers from 8 to 18 ins. diameter, at $32,000. List of bidders noted on Nov. 12.

TOLEDO, OHIO.—Bids are asked by the Board of Public Service until noon, Nov. 27, for the construction of sewer No. 1,051. Reynold Voit is Secy. Bd.

INDIANAPOLIS, IND.—Plans are being prepared by Charles A. Brown, Asst. City Engr., for the last portion of a complete system of sanitary sewers in Riverside Pl. The new portion will be about three miles long and will cost from $12,000 to $15,000. It will connect with the Harding St. sewer at Crawfordsville road and will run east to Hiawatha St., north to the first alley north of Indiana Ave., west to Gent St., and will have branches in the alleys east of Gent, Montcalm and Milburn Sts.

MUSKEGON, MICH.—Bids will be received until noon, Dec. 7, by B. H. Tellman, City Recdr., for furnishing material and constructing a sanitary sewer from the manhole on the north line of Grand Ave. on Clinton St. to the center line of Southern Ave.

GRAND RAPIDS, MICH.—Plans and specifications for sewage pumping machinery are on file at the office of Engineering News, New York. Bids are asked until Nov. 27.

JACKSON, MICH.—The citizens on Nov. 3 voted to issue $40,000 of bonds for the completion of the Harmon drain trunk sewer. A. B. Stevens is City Engr.

MENOMINEE, MICH.—The citizens on Nov. 3 voted to issue $30,000 of bonds for sewers and street improvements. Albert Hass, of Menominee is Engr.

CHICAGO, ILL.—See item under Water Supply—Irrigation.

ST. PAUL, MINN.—The contract for constructing a sewer on Delaware Ave. and Baker St. was awarded on Nov. 5 by the city to D. W. MOORE, 902 Edmund St., at $11,397. L. W. Rundlett is City Engr.

LEXINGTON, NEB.—Bids are asked by the city until Nov. 27 for the construction of pipe sewers. Estimated cost, $16,000. A. C. Maxwell is City Clk.

ST. LOUIS, MO.—Bids are asked until noon, Nov. 24, by the Board of Public Improvements for the construction of sewers in certain streets. W. B. Dryden is Secy. Bd.

ABERDEEN, WASH.—Bids will be received until Nov. 25 for the improvement of H St. by laying sewers, etc.

EL CENTRO, CAL.—Bids will be received by the Board of Trustees until 6 p. m., Dec. 8, for the sale of septic sewer bonds for $40,000. H. P. Pearson, Jr., is City Engr.

SELMA, CAL.—W. F. HANRAHAN, of Palo Alto, Cal., the lowest bidder, has been awarded the contract for constructing a sewer system for the city. There are 15 miles of pipe to be laid and a septic tank to be constructed.

SALT LAKE CITY, UTAH.—We are officially advised that all bids were rejected on Oct. 23 by the Board of Public Works for the construction of an engineer's dwelling house at the main intercepting sewer pumping station. The bidders were: P. M. Anderson, $3,594; Louis A. Geisler, $3,466. Louis C. Kelsey is City Engr.

SALT LAKE CITY, UTAH.—We are officially advised that bids were opened as follows on Oct. 23 for the construction of a brick building for suction gas producer plant at main intercepting sewer pumping station: P. M. Anderson, $4,573; LOUIS A. GEISLER, $3,425 (awarded contract). Louis C. Kelsey is City Engr.

GARBAGE DISPOSAL.

(denotes that this work is advertised in Engineering News.)*

WILLIMANTIC, CONN.—The contract for the removal of garbage has been awarded to JOSEPH MORRIS for a period of two years, beginning Dec. 1.

BEAVER FALLS, PA.—The following bids have been received by the Borough Council for the erection of a garbage furnace: Lewis & Kitchen, New York and 433 Wabash Ave., Chicago, Ill., $7,295, $8,420 and $9,841 for three different sizes; the Morse Boulger Destructing Co., 39 Cortlandt St., New York, $4,800, $7,400, $7,975 and $10,350 for four sizes; the Dixon Engineering & Construction Co., Toledo, Ohio, $6,100, $7,000 and $7,950 for three sizes. The furnace will have a capacity of from 20 to 25 tons every 25 hrs.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

SALEM, N. H.—We are officially advised that the contract for the construction of 4,000 ft. of macadam road here has been awarded by A. W. Dean, State Engr, Concord, to EDWARD ADAMS, North Andover, Mass. Bids were opened on Nov. 7.

BOSTON, MASS.—The C. W. DOLOFF & CO., 20 Central St., Boston, have secured contracts from the Boston & Albany Co. to pave about 11,000 yds. and to set 7,000 ft. of curbstone at both the Kneeland St. yard, Boston, and the East Cambridge yard, furnishing all material, from the New York, New Haven and Hartford R. R. Co., to set curbstone and repave Binford St., South Boston, and on T Wharf, Boston, to furnish and set curbstone, and furnish and lay new blocks, furnishing all material, on the south side of T Wharf.

HARTFORD, CONN.—Bids for the construction of state roads will be received at the office of the State Highway Commissioner, Capitol, Hartford, until 2 p. m., Nov. 20, as follows: Town of Middlefield, 2,525 lin. ft. macadam, including four 15-in. and one 24-in. tile culverts on the Station Road, and 3,370 lin. ft. macadam, including one 15-in. and one 12-in. tile culverts on the Durham Turnpike; town of Monroe, 3,200 lin. ft. grading, including one 18-in. and two 12-in. tile culverts on Newtown Turnpike, and 2,500 lin. ft. grading, including one 24-in. and one 20-in. tile culverts on Shelton Road; town of Berlin, 11,200 lin. ft. macadam-telford, including two 30-in., three 24-in., three 12-in., three 15-in., and one 20-in. tile culverts on the Hartford Turnpike.

BROOKLYN, N. Y.—Bids were received on Nov. 11, as follows, by Bird S. Coler, Boro. Pres., for regulating and repaving with asphalt on a concrete foundation the roadway of (a) St. Felix St., from Lafayette Ave. to Hanson Place, together with all incidental work; (b) Marcy Ave., from Middleton St. to Flushing Ave., together with all incidental work; (c) Fleet St., from De Kalb Ave. to Hudson Ave., together with all incidental work; (d) Prospect Pl., from Carlton Ave. to Underhill Ave., together with all incidental work; (e) Lincoln pl., from Brooklyn Ave. to Troy Ave., together with all incidental work; (f) Franklin Ave., from Jefferson Ave. to Atlantic Ave., together with all incidental work; (g) Arlington Ave., from Jamaica Ave. to Fulton St., together with all incidental work; (h) Classon Ave., from Fulton St. to Bergen St., with all incidental work; (i) Underhill Ave., from St. Marks Ave. to Sterling Pl., together with all incidental work: Standard Asphalt & Rubber Co., 115 Broadway, New York, (a) $4,127, (c) $6,168, (e) $13,597, (g) $37,833, (h) $13,488, (i) $10,660; Uvalde Asphalt Paving Co., 1 Broadway, New York, (a) $4,620, (b) $7,203, (c) $6,622, (d) $17,232, (e) $15,973, (f) $7,688, (g) $40,088, (h) $14,649, (i) $11,837; Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., Brooklyn, (a) $4,386; (b) $6,979, (c) $6,633, (d) $16,833, (e) $15,065, (f) $7,602, (g) $42,797, (h) $15,204, (i) $11,092; Warren Asphalt Paving Co., 93 Federal St., Boston, Mass., (a) $4,382, (c) $6,524, (d) $16,911, (e) $15,033, (g) $41,292, (h) $14,544, (i) $11,325; Barber Asphalt Paving Co., 30 Church St., New York, (a) $4,417, (b) $7,442, (c) $6,547, (d) $17,491, (e) $15,302, (f) $7,864, (g) $41,653, (h) $14,622, (i) $11,768; Cranford Co., 52 Ninth St., Brooklyn, (a) $4,319, (b) $7,171, (c) $6,423, (d) $16,637, (e) $14,561, (f) $7,653, (g) $41,759; (h) $14,146, (i) $11,207.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Dec. 2, by Bird S. Coler, Boro. Pres., for regulating and repaving with asphalt and granite on a concrete foundation, the roadways of certain streets; also for regulating, curbing, grading and laying sidewalks in various streets.

NEW YORK, N. Y.—Bids are asked by Louis F. Haffen, Pres. Boro. of The Bronx, until 11 a. m., Dec. 1, for paving and repairing with asphalt blocks on a concrete foundation, the roadways of various streets; also for regulating, grading, setting curbstones, flagging the sidewalks, laying crosswalks and building approaches.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Dec. 3, by the Park Board for furnishing and delivering new straight 5-in. bluestone curbstones along Broadway where required, between 65th and 80th Sts., in the Borough of Manhattan. Henry Smith is Pres. Bd.

NEW YORK, N. Y.——Bids were received as follows on Nov. 9 by Louis F. Haffen, Pres. Boro. of The Bronx, for (a) paving with asphalt pavement on a concrete foundation the roadway of 165th St., between Webster Ave. and Morris Ave., and the roadway of Clay Ave., between 164th St. and 165th St., and resetting curb where necessary; (b) paving with asphalt pavement on a concrete foundation the roadways and sidewalks of the bridges over the New York, New Haven & Hartford R. R. (Harlem River Branch) at Longwood Ave., Tiffany St., Westchester Ave., Tremont Ave., West Farms Road, White Plains Road, Unionport Road, Williamsbridge Road and Baychester Ave.; (c) paving with asphalt pavement on a concrete foundation the roadways and sidewalks of the bridges over the New York, New Haven & Hartford R. R. (Harlem River Branch) at East 149th St., Leggett Ave., Lafayette Ave., Barrette St., Longfellow Ave. and Ludlow Ave.: Barber Asphalt Paving Co., 30 Church St., New York, (a) $16,385, (b) $19,080, (c) $11,528; Continental Asphalt Paving Co., 79 Wall St., (a) $16,124; Hastings Pavement Co., 25 Broad St., New York, (a) $16,488; Standard Asphalt & Rubber Co., 115 Broadway, New York, (b) $18,754, (c) $11,322.

NEW BRIGHTON (S. I.), N. Y.—Bids were received as follows on Nov. 10 by George Cromwell, Pres. Borough of Richmond, for (a) furnishing all the labor and materials required for regulating and repaving with vitrified brick pavement on a concrete foundation the gutters of Harrison Ave., from Richmond Ave. to Nicholas Ave.; Housman Ave., from Richmond Terrace to a point about 440 ft. south of Cedar St.; Simonson Ave., from Richmond Ter. race to a point about 300 ft. south of the Staten Island Rapid Transit R. R. crossing, and Pennsylvania Ave., from New York Ave. to Bay St., together with all work incidental thereto; (b) furnishing the labor and materials required for regulating and repaving with slag block pavement on a concrete foundation the roadways of Water St., from a point about 86 ft. south of Richmond Terrace to the south side of Woodruff Lane; Water St., to Barker St., from Woodruff Lane to Barker St., Trinity Place, together with all work incidental thereto: Joseph Johnson's Sons, 193 Broadway, West New Brighton, (a) $15,487, (b) $8,905; C. J. Quinlan, Port Richmond (S. I.), N. Y., (a) $[illegible]; Bonnaci & Vinitti Construction Co., (a) $17,979; Quinrox Construction Co., West Brighton, (a) $17,914; John E. Donavan, 20 Morning Road, West Brighton, (a) $16,250, (b) [illegible]; Thomas Carlin Construction Co., (a) $[illegible]; Uvalde Asphalt Paving Co., 1 Broadway, New York, (b) $8,452.

ALBANY, N. Y.—The Board of Contract and Supply on Nov. 7 awarded the contract to JOHN M. HOLLER, Albany, for paving Sherman St., between Northern Boulevard and Lark St., at $6,534.

ALBANY, N. Y.—The opening of bids for the construction of State highways by Frederick Skene, State Engr., was advertised for noon, Nov. 9, was postponed until the following day. This was made necessary because of an injunction obtained by Patrick Lillis, of Troy, and served on the State Engineer, forbidding him to open the bids or award the contracts; the grounds on which Mr. Lillis' action was based being that he had not been given full opportunity to submit bids on the work. The matter was heard in court the following morning and the injunction was vacated. The following bids were received: Post Road No. 309, Ulster County, 6.48 miles, James E. Martin, Poughkeepsie, N. Y., $68,029; DeGraff & Hogeboom, Bloomington, N. Y., $60,274; McNamee & Rice, Rondout, N. Y., $58,544; Thomas O'Hern, $52,117; R. S. Kasson, Glen Falls, N. Y., $59,169. Shanley-Morrissey, 527 Fifth Ave., New York, $63,892.

Reservation-Varick Road No. 321, Seneca County, 4.31 miles, Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave., New York, $43,299; Booth & Flynn, Pittsburg, Pa., $44,947; H. C. Schroeder, Rochester, N. Y., $57,691; Fred A. Brotsch, Rochester, $35,156; John H. Gordon, Albany, $39,922.

Sprakers-Rural Grove Road No. 346, Section 2, Montgomery County, 2.52 miles, D. S. Snell & Co., Canajoharie, N. Y., $16,401; Shanley-Morrissey Co., New York, $16,397; Central & Eastern Construction Co., 647 Broadway, Albany, $15,723.

Canajoharie-Sharon Springs Road No. 347, Montgomery County, 2.94 miles, D. S. Snell & Co., Canajoharie, N. Y., $27,030; Joseph Walker, New Paltz, N. Y., $25,278; F. E. Ellis, Melrose, Mass., $33,634; Shanley-Morrissey Co., New York, $28,805; Central & Eastern Construction Co., Albany, $25,377.

Oak Orchard Road No. 392, Section 1, Orleans County, 2.362 miles, W. Truesdale, $20,851; Holihan & Dailey, Rochester, $20,372; Chambers & Grady, Rochester, $21,062; F. A. Brotsch, Rochester, $18,342; Greece Construction Co., Rochester, $19,949; Mosier & Summers, Buffalo, $21,936; F. W. Knickenberg, Buffalo, $21,096; Booth & Flynn, Pittsburg, $21,223; Thomas Hucknell, Albion, N. Y., $20,412; Stewart-Kerbaugh-Shanley Co., New York, $27,556.

Port Jervis-Sullivan County Line Road No. 412, Section 1, Orange County, 5.74 miles, Joseph Walker, New Paltz, $56,430; J. C. Tierney, $64,879; Bellew & Merritt, Tuckahoe, N. Y., $57,628; Shanley-Morrissey Co., New York, $63,503; Orange County Road Co., $63,657; DeGraff & Hogeboom, Bloomington, $55,401; Spuyten Duyvil Construction Co., New York, $69,081; F. J. Gallagher, $70,694; J. E. Consaulis, 34 Beaver St., New York, $60,335.

Highland Mills-Monroe Road No. 413, Orange County, 3.27 miles, Orange County Roads Construction Co., $32,712; Joseph Walker, New Paltz, $31,548; DeGraff & Hogeboom, Bloomington, $30,410; Shanley-Morrissey Co., New York, $30,970. Philadelphia Road No. 440, Jefferson County, 54 miles (bids are for granite and limestone, respectively), Cement P. & C. Co., $41,639 and $45,025; Brown & Lowe, Schenectady, $54,881, $59,904; Buckley Construction Co., Plattsburgh, $43,202, $41,609; Spuyten Duyvil Construction Co., New York, $46,270, $43,762; Chambers & Grady, Rochester, $49,987, $53,173; Ripton & Murphy, $65,962, $64,988; William J. Semper, Watertown, N. Y., $45,706, $45,706.

Riverside Drive Road No. 444, Broome County, 1.14 miles (bids are for syenite and trap rock, respectively), Newport Construction Co., Newport, N. Y., $11,565 and $12,186; Edwin D. Baker, $12,554, $12,547. Manheim Centre-Salisbury Road No. 463, Herkimer County, $5.52 miles, Joseph Walker, New Paltz, $64,248; Brown & Lowe, Schenectady, $71,382; S. A. Seymour, $75,047; Shanley-Morrissey Co., New York, $66,664; Buckley Construction Co., Plattsburgh, $61,825; Bellew & Merritt, Tuckahoe, N. Y., $61,735.

Salisbury Centre-Stratford Road No. 464, Herkimer County, 5.46 miles, Kingsbury Construction Co., Sandy Hill, $45,018; Rockefeller Bros., Brooklyn, N. Y., $38,839; Hallinan Bros., Herkimer, $51,072; Newport Construction Co., Newport, $44,406; Brown & Lowe, Schenectady, N. Y., $47,130; C. H. Flanigan, Albany, $44,014; Malloy & Davis, Schenectady, N. Y., $39,929; Shanley-Morrissey Co., New York, $40,871; Buckley Construction Co., Plattsburgh, $40,427; Bellew & Merritt, Tuckahoe, N. Y., $44,889.

Buffalo Road No. 480, Section 4, Monroe County, 3.02 miles, F. W. Knickenberg, Buffalo, $33,054; Greece Construction Co., Rochester, $35,124; Booth & Flynn, Pittsburg, Pa., $37,755; Stewart-Kerbaugh-Shanley Co., New York, $35,675; Mosier & Summers, Buffalo, $34,938; F. A. Brotsch, Rochester, $38,897.

Dispatch-Pittsford Road No. 481, Monroe County, .99 miles; Greece Construction Co., Rochester, $15,5[illegible]; Booth & Flynn, Pittsburg, Pa., $16,2[illegible]; Monroe Roads Co., Pittsford, $12,550; Stewart-Kerbaugh-Shanley Co., New York, $14,[illegible]; F. A. Brotsch, Jr., Rochester, $13,4[illegible]; A. J. Rockwood, Rochester, $14,897; Newport Construction Co., Newport, N. Y., $17,[illegible].

Tully Road No. [illegible]9, Onondaga County, 4.44 miles, Stewart-Kerbaugh-Shanley Co., New York, $42,175; Booth & Flynn, Pittsburg, Pa., $38,052; A. J. Rockwood, Rochester, $36,646. Hilton-Bartletts Corners Road No. 491, Monroe County, 1.01 miles, John Boylin, Barnards, N. Y., $7,788; Greece Construction Co., Rochester, $8,478; F. A. Brotsch, Rochester, $9,[illegible]; Booth & Flynn, Pittsburg, Pa., $8,462; Stewart-Kerbaugh-Shanley Co., New York, $8,[illegible]; Thomas Hucknall, Albion, $8,041; R. J. [illegible] $8,164.

Mendon-Pittsford Road No. 493, Monroe County, 6.26 miles; Monroe Roads Co., Pittsford, $52,513; F. A. Brotsch, Jr., Rochester, $46,983; Greece Construction Co., Rochester, $52,129; A. J. Rockwood, Rochester, $52,361; Mosier & Summers, Buffalo, $51,621; Holihan & Dailey, Rochester, $48,308 (declared informal); Booth & Flynn, Pittsburg, Pa., $54,565; Stewart-Kerbaugh-Shanley Co., New York, $57,[illegible].

Troy-Spiegletown Road No. 504, Rensselaer County, 1.69 miles, Elmore & Hamilton, Albany, $15,905; Thomas H. Karr, Troy, $14,24[illegible]; Fred E. Ellis, $22,454; Central & Eastern Construction Co., $15,776; Reardon & Gilchrist, Glens Falls, $16,512.

Schodack Centre-Nassau Road No. 536, Rensselaer County, 5.19 miles, Rockefeller Bros., 30 Lenox Row, Brooklyn, N. Y., $49,-895; Elmore & Hamilton, Albany, $50,179; Joseph Walker, New Paltz, $55,169; Thomas H. Karr, Troy, $50,515. Johnstown-Broadalbin Road No. 543, Section 2, Fulton County, 6.35 miles, Kingsbury Construction Co., Sandy Hill, $46,559; Brown & Lowe, Schenectady, $52,326; Buckley Construction Co., Plattsburgh, $47,288; Rockefeller Bros., Brooklyn, $46,140; DeGraff & Hogeboom, Bloomington, $41,682; Malloy & Davis, Schenectady, $43,885; Bellew & Merritt, Tuckahoe, $49,481; Linehan & Burnham Co., Sandy Hill, $47,645; Shanley-Morrissey Co., New York, $50,161.

Willetts-East Williston-Westbury Pond Road No. 547, Nassau County, 6.43 miles, Andrews Bros., Mineola (L. I.), N. Y., $69,120; Bellew & Merritt, Tuckahoe, $69,428; Henry J. Mullen, $68,310; Twombly & Eidert, Jamaica (L. I.), N. Y., $74,183; Robertson & Gerehart Co., New York, $65,125; Long Island Construction & Supply Co., Long Island City (L. I.), N. Y., $63,190.

Fly Road No. 553, Onondaga County, 2.33 miles, Stewart-Kerbaugh-Shanley Co., New York, $17,900; Booth & Flynn, Pittsburg, Pa., $19,416; F. A. Brotsch, Jr., Rochester, $15,565; C. H. Flanigan, Albany, $19,333.

Fabius Road No. 554, Onondaga County, 4.91 miles, Booth & Flynn, Pittsburg, Pa., $44,-698; Stewart-Kerbaugh-Shanley Co., New York, $49,826; Joseph McCormick, Jr., 315 Taunton Ave., Providence, R. I., $41,526.

The following contracts for the above work have been awarded: To FREDERICK A. BROTSCH, Rochester New York., Reservation Road-Varick No. 321, Seneca County, 4.31 miles, $35,156; Oak Orchard Road No. 332, Section 1, Orleans County, 3.342 miles, $18,342; Fly Road No. 553, Onondaga County, 2.33 miles, $15,565; to CENTRAL & EASTERN CONSTRUCTION CO., 647 Broadway, Albany, N. Y., Sprakers-Rural Grove Road No. 346, Section 2, Montgomery County, 2.52 miles, $15,723; to JOSEPH WALKER, New Paltz, N. Y., Canajoharie-Sharon Springs Road No. 347, Section 2, Montgomery County, 2.94 miles, $25,278; to BUCKLEY CONSTRUCTION CO., Plattsburgh, N. Y., Philadelphia Road No. 440, Jefferson County, 5.4 miles, $41,609 (limestone); to ROCKEFELLER BROS., Brooklyn, N. Y., Salisbury Center-Stratford Road No. 464, Herkimer County, 5.46 miles, $38,839; Schodack Center-Nassau Road No. 536, Rensselaer County, 5.19 miles, $48,895; to F. W. KNICKENBERG, Buffalo, N. Y., Buffalo Road No. 480, Section 4, Monroe County, 3.02 miles, $33,024; to MONROE ROADS CO., Pittsford, N. Y., Despatch-Pittsford Road No. 481, Monroe County, .99 miles, $12,550; to A. J. ROCKWOOD, Rochester, N. Y., Tully Road No. 489, Onondaga County, 4.44 miles, $36,646; to JOHN BOYLIN, Barnards, N. Y., Hilton-Bartletts Corners Road No. 491, Monroe County, 1.01 miles, $7,778; to MOSIER & SUMMERS, 1266 Seneca St., Buffalo, N. Y., Mendon-Pittsford Road No. 493, Monroe County, 6.26 miles, $51,621; to THOMAS H. KARR, Troy, N. Y., Troy-Spiegletown Road No. 504, Rensselaer County, 1.69 miles, $14,245; to DEGRAFF & HOGEBOOM, Bloomington, N. Y., Johnstown-Broadalbin Road No. 543, Section 2, Fulton County, 6.35 miles, $41,680; to LONG ISLAND CONSTRUCTION & SUPPLY CO., Long Island City, N. Y., Willetts-East Williston-Westbury Pond Road No. 547, Nassau County, 6.43 miles, $63,190; to JOSEPH McCORMICK, Taunton Ave., Providence, R. I., Fabius Road No. 554, Onondaga County, 4.91 miles, $41,526.

ALBANY, N. Y.—The following bids were received on Nov. 11 by Frederick Skene, State Engr., for the construction of good roads: Rome-Augusta-Westmoreland Road No. 564, Oneida County, 5.02 miles: Newport Construction Co., Newport, N. Y., $42,-067 (for syenite), $48,116 (for trap rock); Brown & Lowe, Schenectady, N. Y., $47,148 and $54,409; Buckley Construction Co., Plattsburg, N. Y., $51,450 and $51,450; Charles H. Flanigan, Albany, N. Y., $41,134 and $57,116; Hyde & Hyde, Rome, N. Y., $54,[illegible] and $57,096; Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave., New York, $54,[illegible] and $56,094.

Spring Ave Road, Troy-Poestenkill No. 571, Rensselaer County, 2.61 miles: Thomas H. Karr, Troy, N. Y., $20,328; Newport Construction Co., Newport, N. Y., $23,604.

Towners Corners-County Line Road No. 585, Putnam County, 3.93 miles: John F. Creeden, New York, $37,145; H. V. Sproul, Peekskill, N. Y., $36,841; Ryan & Yale, Brewsters, N. Y., $37,934; James E. Martin, Poughkeepsie, N. Y., $37,481; Amos D. Bridges' Sons, Hazardville, Conn., $38,438; John Turnane, Carmel, N. Y., $38,857.

Troy-Schenectady Road No. 604, Section 3, Albany County, 3.88 miles: Elmore & Hamilton, Albany, N. Y., $31,935; S. B. Van Wagonen, Rondout, N. Y., $35,451; Browne & Lowe, Schenectady, N. Y., $33,558; Morris Kantrowitz, Albany, N. Y., $32,924; Malloy & Davis, Schenectady, N. Y., $31,023; John Harrigan, New York, $27,697; Harvey Leamon, Schenectady, N. Y., $36,060.

Mechanicville-Malta Road No. 610, Saratoga County, 7.42 miles: Shanley-Morrissey Co., Inc., New York, $74,666; Richmond F. Hudson, Melrose, Mass., $71,992; Reardon & Gilchrist, Glens Falls, N. Y., $72,797; Kingsbury Construction Co., Sandy Hill, N. Y., $64,215; Thomas H. Karr, Troy, N. Y., $61,873; Putnam & Hare, New York, $70,009; Spuyten Duyvil Construction Co., New York, $89,404; Malloy & Davis, Schenectady, N. Y., $63,793; Charles H. Flanigan, Albany, N. Y., $70,501; Elmore & Hamilton, Albany, N. Y., $63,874; Joseph Walker, New Paltz, N. Y., $63,665; Newport Construction Co., Newport, N. Y., $67,989; Linehan & Burnham Co., Glens Falls, N. Y., $64,217; Gaylord & Fox, Saratoga Springs, N. Y., $66,719; Buckley Construction Co., Plattsburg, N. Y., $66,584.

Pawling-Dover Town Line Road No. 612, Dutchess County, 2.92 miles: Shanley-Morrissey Co., New York, $32,957; Samuel Beskin, Fishkill, N. Y., $33,756; Bellew & Merritt, Tuckahoe, N. Y., $30,526; Harvey V. Sproul, Peekskill, N. Y., $34,806; Lane Construction Co., Meriden, Conn., $32,691; James E. Martin, Poughkeepsie, N. Y., $31,564; Joseph Walker, New Paltz, N. Y., $29,323; General Construction Co., Bridgeport, Conn., $29,915.

Wicopee-Beekman Road No. 627, Dutchess County, 8.1 miles: Harvey B. Sproul, Peekskill, $62,964; Shanley-Morrissey Co., New York, $69,883; S. B. Van Wagenen, Rondout, $63,073; McNamee & Rice, Kingston, N. Y., $63,666; James E. Martin, Poughkeepsie, $64,717; Samuel Beskin, Fishkill, N. Y., $69,-620; J. E. Consaulis, 34 Beaver St., New York, $56,474; Lane Construction Co., Meriden, $60,263; R. S. Kasson, Glens Falls, $64,129; Joseph Walker, New Paltz, N. Y., $58,793; Bellew & Merritt, Tuckahoe, N. Y., $61,238; John F. Creeden, New York, $66,-837; Elmore & Hamilton, Albany, $64,274.

Troy-Schenectady Road No. 630, Section 4, Albany County, 2.24 miles: Harvey Leamon, Schenectady, $22,720; Browne & Lowe, Schenectady, $21,026; M. Kantrowitz, Albany, $19,966; Elmore & Hamilton, Albany, $19,582; F. E. Ellis, Melrose, Mass., $20,808; John Harrigan, New York, $16,726; Malloy & Davis, Schenectady, $19,331.

Indian Fields-Dormansville Road No 646, Albany County, 4.12 miles: Morris Kantrowitz, Albany, $37,712; Frank J. Gallagher, 490 Park Pl., Brooklyn, $44,421; C. H. Flanigan, Albany, $38,808; J. H. Gordon, Albany, $36,795; Malloy & Davis, Schenectady, $39,350; H. B. Sproul, Peekskill, $38,156; Spuyten Duyvil Construction Co., New York, $39,330; Joseph Walker, New Paltz, $32,852; Thomas H. Karr, Troy, $40,541; S. B. Van Wagenen, Rondout, $36,858; Edward K. Uthe, Coeymans, N. Y., $43,782; Shanley-Morrissey, New York, $40,112; Elmore & Hamilton, Albany, $35,159.

Angola-Evans Center, Angola-Brant Road No. 642, Erie County, 6.9 miles: Erie County Board of Supervisors, Buffalo, $88,605; Mosier & Summers, 1266 Seneca St., Buffalo, $84,630; Frank L. Cohn, Buffalo, $86,012; Booth & Flynn, 504 Grant St., Pittsburg, Pa., $95,153; Joseph Dunfee, Syracuse, N. Y., $84,583; Henry P. Burgard Co., 275 Lathrop St., Buffalo, $88,952; E. M. Love & Son, Corry, Pa., $100,856; Stewart-Kerbaugh-Shanley Co., New York, $67,144.

Alden-Town Line Road No. 644, Section 2, Erie County, 7.3 miles: Erie County Board of Supervisors, Buffalo, $8,456; F. W. Knickenburg, Buffalo, $8,417; Stewart-Kerbaugh-Shanley Co., New York, $9,907.

Orchard Park-Griffins Mills Road No. 645, Erie County, 4.64 miles: Frank L. Cohn, Buffalo, $58,463; Stewart-Kerbaugh-Shanley Co., New York, $62,740; Mosier & Summers, Buffalo, $60,572; Booth & Flynn, Pittsburg, Pa., $56,437; F. W. Knickenberg, Buffalo, $57,759; Greece Construction Co., Rochester, $56,923; Henry P. Burgard, Buffalo, $59,028; Erie County Board of Supervisors, Buffalo, $60,224; Joseph Dunfee, Syracuse, $56,538; Thomas Hucknell, Albion, N. Y., $56,933; E. M. Love & Son, Corry, $58,048.

Oswego-Mexico Road No. 654, Section 2, Oswego County, 5.35 miles: (Bids are for local and syenite respectively.) Thomas O'Brien, Watertown, $56,643 and $62,020; W. J. Semper, Watertown, $50,305, $55,145; Spuyten Duyvil Construction Co., New York, $46,460, $70,011; Casey & Murray, Rochester, $48,528, $60,282; C. H. Flanigan, Albany, $50,020, $64,940; Burns Bros. & Haley, Watertown, $55,385, $63,845; Booth & Flynn, Pittsburg, (Bids not filled out); Chambers & Grady, Rochester, $49,443, $62,498; Stewart-Kerbaugh-Shanley Co., New York, $54,950, $64,-649; Central & Eastern Co., Albany, $50,685, $54,042; Joseph H. Conners, Fulton, N. Y., $51,905, $55,635.

Otselic-South Otselic Road No. 663, Section 2, Chenango County, 4.42 miles: (Bids are for limestone and syenite respectively.) Delaware Construction Co., Sidney, N. Y., $56,687, $56238; Booth & Flynn, Pittsburg, $52,547, $46,138; John H. Gordon, Albany, $48,234, $47,521; Casey & Murray, Rochester, $58,008, $53,014; Stewart-Kerbaugh-Shanley Co., New York, $56,367, $52,408.

Ithaca-Dryden Road No. 681, Section 1, Tompkins County, 5.23 miles: (Bids are for limestone, syenite and trap respectively.) Casey & Murray, Rochester, $62,527, $64,200 and $64,758; Standard Construction Co., Wilkes-Barre, Pa., $55,177, $57,854, $58,526; Spuyten Duyvil Construction Co., New York, $62,638, $66,886, $69,031; A. J. Rockwood, Rochester, $56,058, $62,751; $63,309; P. D. Conley, Ithaca, N. Y., $55,659, $57,333, $59,-006; Stewart-Kerbaugh-Shanley, New York, $59,899, $64,519, $66,856; A. P. Robinson, Cortland, N. Y., $62,870, $67,890, $70,490.

Hudson-Hollowville Road No. 650, Columbia County, 5.66 miles: Godwin Construction Co., 30 Church St., New York, $89,503; H. B. Sproul, Peekskill, $61,217; Elmore & Hamilton, Albany, $54,546; Spuyten Duyvil Construction Co., New York, $63,101; Joseph Walker, New Paltz, $56,317; Shanley-Morrissey, New York, $63,003; John F. Creeden, New York, $59,673.

Champlain-Perrys Mills Road No. 652, Clinton County, 3.25 miles: W. B. Spellman, Chateaugay, N. Y., $22,108; J. F. Creeden, New York, $24,808; Kingsbury Construction Co., Sandy Hill, $22,176; Spuyten Duyvil Construction Co., New York, $26,691; Buckley Construction Co. Plattsburg $24,069.

Geneva-Halls Corners Road No. 655, Ontario County, 5.04 miles: Nelson Meredith Co., Chambersburg, Pa., $45,273; Edward Suybolt, Geneva, N. Y., $45,882; Hulahan & Daley, Rochester, $38,206; Henry P. Burgard Co., Buffalo, $40,968; Chambers & Grady, Rochester, $45,114; Spuyten Duyvil Construction Co., New York, $41,293; A. J. Rockwood, Rochester, $40,245; Monroe Roads Co., Pittsford, N. Y., $37,919; Mosier & Summers, Buffalo, $41,626; F. A. Brotsch, Rochester, $43,701; John F. Dolan Contracting Co., New York, $42,357; Booth & Flynn, Pittsburg, Pa., $43,108; H. C. Schroeder, Rochester, $43,581; Greece Construction Co., Rochester, $38,310; Stewart-Kerbaugh-Shanley Co., New York, $47,479; E. M. Love & Son, Corry, Pa., $41,434.

Stanley-Geneva Road No. 636, Ontario County, 3.16 miles: Monroe Roads Co., Pittsford, $17,334; Nelson Merydith Co., Chambersburg, Pa., $24,704; Hulahan & Daley, Rochester, $20,563; F. A. Brotsch, Rochester, $23,082; Spuyten Duyvil Construction Co., New York, $23,104; Greece Construction Co., Rochester, $21,450; Henry P. Burgard Co., Buffalo, $23,064; Stewart-Kerbaugh-Shanley Co., New York, $23,838; John F. Dolan Contracting Co., New York, $22,532; H. C. Schroeder, Rochester, $22,933; Booth & Flynn, Pittsburg, Pa., $25,518; Mosier & Summers, Buffalo, $22,420; A. J. Rockwood, Rochester, $21,961; E. M. Love & Son, Corry, $23,877.

Stirling-Oswego Road No. 685, Cayuga County, 4.88 miles: (Bids are for syenite and trap respectively.) Chambers & Grady, Rochester, $56,751 and $59,602; Casey & Murray, Rochester, $55,736, $57,574; Burns Bros. & Haley, Watertown, $58,268, $59,865; Stewart-Kerbaugh-Shanley Co. New York, $57,423, $60,052.

Munsey-Egypt Corners Road No. 690, Rockland County, 4.25 miles: Shanley-Morrissey Co., New York, $38,046; Bellew & Merritt, Tuckahoe, $33,085; John F. Creeden, New York, $30,062; John E. Consaulus, New York, $28,480; Rowe Contracting Co., Melrose, Mass., $38,755; Fusco-Gurnee Co., Newark, N. J., $25,654.

Contracts for the above work have been awarded as follows: To BROWN & LOWE, Schenectady, N. Y., Rome-Augusta-Westmoreland Road No. 564, Oneida County, 5.02 miles, $47,149 (syenite). (The low bid of the Newport Construction Co. was rejected as informal.) To THOMAS H. KARR, Troy, N. Y., Spring Ave., Troy-Poestenkill Road No. 571, Rensselaer County, 2.61 miles, $20,323; to HARVEY V. SPROUL, Peekskill, N. Y., Towners Corners-County Line, Road No. 585, Putnam County, 3.93 miles, $36,841; to JOHN HARRIGAN, New York, Troy-Schenectady Road No. 604, Section 3, Albany County, 3.88 miles, $27,697; all bids for Mechanicville-Malta Road No. 610, Saratoga County, 7.42 miles, were rejected; to JOSEPH WALKER, New Paltz, N. Y., Pawling-Dover Town Line, Road No. 612, Dutchess County, 2.92 miles, $29,323 Indian Fields-Dormansville Road No. 646, Albany County, 4.12 miles, $32,852; Hudson-Hollowville Road No. 650, Columbia County, 5.66 miles, $56,-317. (The low bid of Elmore & Hamilton for Road No. 650 was rejected on account of errors in computation.) To JOHN E. CONSAULUS, Saugerties and 34 Beaver St., New York, Wicopee-Beekman Road No. 627, Dutchess County, 8.1 miles, $56,474; Monsey-Egypt Corners Road No. 690, Rockland County, 4.25 miles, $28,475. (The low bid of Fusco-Gurnee for Road No. 690 was rejected on account of errors in computation.) To MALLOY & DAVIS, Schenectady, N. Y., Troy and Schenectady Road No. 630, Albany County, 2.24 miles, $19,331. (Low bid of John Harrigan for this road was rejected as informal.) To MONROE ROADS CO., Pittsford, N. Y., Geneva-Halls Corners Road No. 635, Ontario County, 5.04 miles, $37,919. To HOLIHAN & DAILEY, Rochester, N. Y., Stanley-Geneva Road No. 636, Ontario County, 3.16 miles, $20,563. (Low bid of Monroe Roads Co. rejected as informal.)

To JOSEPH DUNFEE, Syracuse, N. Y., Angola-Evans Center, Angola-Brant Road No. 642, Erie County, 6.9 miles, $84,583. (Low bid of Stewart-Kerbaugh-Shanley Co., though lowest on face, had one item omitted which, if added, would have increased bid to $92,000.) To F. W. KNICKENBERG, Buffalo, N. Y., Alden-Town Line Road No. 644, Section 2, Erie County, .73 miles, $8,417. To BOOTH & FLYNN, Pittsburg, Pa., Orchard Park-Griffins Mills Road No. 645, Erie County, 4.64 miles, $56,434. To W. B. SPELLMAN, Chateaugay, N. Y., Champlain-Perrys Mills Road No. 652, Clinton County, 3.25 miles, $22,108. To CENTRAL & EASTERN CONSTRUCTION CO., Albany, N. Y., Oswego-Mexico Road No. 654, Section 2, Oswego County, 5.350 miles, $54,042.25. To JOHN H. GORDON, Albany, N. Y., Otselic-South Otselic Road No. 663, Section 2, Chenango County, 4.42 miles, $48,224. To P. D. CONLEY, Ithaca, N. Y., Ithaca-Dryden Road No. 681, Tompkins County, 5.23 miles, $57,338. To STEWART-KERBAUGH-SHANLEY CO., 527 Fifth Ave., New York, Stirling-Oswego Road No. 685, Cayuga County, 4.88 miles, $57,423.

ALBANY, N. Y.—The following bids were received by Frederick Skene, State Engr., on Nov. 13, for the construction of public highways:

Sidney—Unadilla Road No. 708. Otsego County, 4.6 miles (bids are for gneiss, trap, limestone and granite, respectively): Delaware Construction Co., Sidney, N. Y., $50,-721, $50,722, $45,518, $50,722. Newport Construction Co., Newport, N. Y., $38,502, $43,-715, $42,172, $48,200. John Harrigan, New York, $35,040, $35,541, $33,063, $35,040. Elmore & Hamilton, Albany, $37,217, $37,217, $31,715, $37,217.

North Tonawanda—Shawnee Road No. 713, Niagara County, 5.13 miles: Thomas Hucknall, Albion, N. Y., $43,542; E. M. Love & Son, Corry, Pa., $35,671; Stewart-Kerbaugh-Shanley Co., New York, $44,780; Greece Construction Co., Rochester, $39,383; Huff & Shannon, Buffalo, $41,425; Bellew & Merritt Co., Tuckahoe, N. Y., $38,706; John P. Johnson, Buffalo, $42,886; Frank L. Cohen, Buffalo, $46,680; Henry C. Schroeder, Rochester, $44,441; Booth & Flinn, Pittsburg, Pa., $48,-823; Mosier & Summers, Buffalo, $43,431; Joseph Dunfee, Syracuse, $44,737; F. A. Brotsch, Rochester, $45,775.

Evansville—Mt. Morris (Sec. 1) Road No. 714, Livingston County, 5.37 miles: Booth & Flinn, Pittsburg, $61,008; Mosier & Summers, Buffalo, $60,830; Henry C. Schroeder, Rochester, $56,148; Greece Construction Co., Rochester, $56,945; A. J. Rockwood, Rochester, $59,130; Chambers & Grady, Rochester, $61,142; H. P. Burgard Co., Buffalo, $63,280; Bellew & Merritt Co., Tuckahoe, $58,195; Holihan & Daley, Rochester, $57,-967; Stewart-Kerbaugh-Shanley Co., New York, $65,058; E. M. Love & Son, Corry, Pa., $57,125.

Whitehall-Fort Ann—Town Line Road No. 723, Washington County, 4.77 miles: John F. Creeden, New York, $33,407; Buckley Construction Co., Plattsburg, $34,399; James Anderson, Glens Falls, N. Y., $35,403; Bellew & Merritt Co., Tuckahoe, N. Y., $36,306; Clinton Beckwith, Herkimer, $37,101; W. J. Semper, Watertown, $34,447; Kingsbury Construction Co., Sandy Hill, $35,031; F. E. Ellis, Melrose, Mass., $42,506; Malloy & Davis, Schenectady, $34,492; Newport Construction Co., Newport, N. Y., $36,060; Joseph Walker, New Paltz, N. Y., $35,137; Reardon & Gilcrest, Glens Falls, $34,942; Putnam & Hare, New York, $31,609; Linehan & Burnham, Glens Falls, $36,009; Shanley-Morrissey, New York, $37,685.

Grand Central Ave. (Sec. 2) Road No. 725, Chemung County, 9 miles: J. C. Bradley, Corning, N. Y., $16,224; Casey & Murray, Rochester, $14,112; Costello & Neagle, Elmira, N. Y., $18,379.

Chittenango—Oneida (Sec. 1) Road No. 727, Madison County, 5.15 miles: No bids received on this road owing to error in advertising.

Potsdam—Parishville (Sec. 1) Road No. 734, St. Lawrence County, 5.12 miles: Casey & Murray, Rochester, $38,333; Cement Paving & Construction Co., Jersey City, N. J., $41,280; Spuyten Duyvil Construction Co., New York, $36,327; McRoberts & Doyle, Ogdensburg, N. Y., $41,496; W. J. Semper, Watertown, $38,271; Buckley Construction Co., Plattsburg, $40,086; Stewart-Kerbaugh-Shanley Co., New York, $39,237.

North Creek—County Line Road No. 736, Warren County, 4.12 miles: Lee Wadell, North Creek, N. Y., $34,698; Shanley-Morrissey Co., New York, $28,105; R. S. Kasson, Glens Falls, $44,729; Bellew & Merritt, Tuckahoe, $33,324.

Cortland-Truxton—Cuyler Road No. 737, Cortland County, 5.79 miles (bids are for trap and syenite, respectively): Newport Construction Co., Newport, $62,258, $59,009; Booth & Flynn, Pittsburg, $61,688, $57,904; Casey & Murray, Rochester, (no bid submitted), $55,909; Spuyten Duyvil Construction Co., New York, $58,377, $54,543; C. H. Flanigan, Albany, N. Y., $59,491, $52,023; Chambers & Grady, Rochester, $55,346, $47,-878; Stewart-Kerbaugh-Shanley Co., New York, $61,036, $56,241; A. P. Robinson, Cortland, $62,370, $56,165.

Delhi—Bloomville Road No. 747, Delaware County, 5.910 miles (bids are for trap and local, respectively): Casey & Murray, Rochester, $72,646, $59,244; Delaware Construction Co., Sidney, N. Y., $76,491, $65,820; John F. Clancy, Astoria, L. I., N. Y., $67,209, $60,-450; John Harrigan, New York, $55,635, $50,067; John F. Creedon, New York, $66,-027, $58,280; Bellew & Merritt, Tuckahoe, $67,396, $59,565; Malloy & Davis, Schenectady, $66,422, $52,146.

Clarence Center Road No. 750, Erie County, 5.95 miles: Greece Construction Co., Rochester, $67,664; Booth & Flynn, Pittsburg, $79,284; Hulahan & Dailey, Rochester, $61,-831; Mosier & Summers, Buffalo, $66,187; A. J. Rockwood, Rochester, $74,272; Erie County Board of Supervisors, Buffalo, $68,-310; F. A. Brotsch, Rochester, $70,360; F. W. Knickenburg, Buffalo, $66,632; Frank L. Cohn, Buffalo, $66,747; Joseph Dunfee, Syracuse, $59,003; John P. Johnson, Buffalo, $64,829; Thomas Hucknall, Albion, N. Y., $64,494; Stewart-Kerbaugh-Shanley Co., New York, $67,335.

Bath-Savona Road No. 754, Steuben County, 1.46 miles John C. Bradley, Corning, $14,794; Booth & Flynn, Pittsburg, $13,692; Stewart-Kerbaugh-Shanley Co., New York, $12,567.

Ossining-Kitchewan Road No. 768, Westchester County, 5.86 miles: Shanley-Morrissey Co., New York, $57,698; Jos. Walker, New Paltz, $50,685; The Decicico Construction Co., Larchmont, N. Y., $44,698; Rowe Contracting Co., Melrose, Mass., $57,341; James E. Martin, Poughkeepsie, $47,695; Harvey B. Sproul, Peekskill, N. Y., $49,520; S. L. Waller, New York, $59,658; McNamee & Rice, Rondout, $53,249; Bellew & Merritt Co., Tuckahoe, $51,973; Goodwin Construction Co., New York, $62,737; William F. McCabe, White Plains, N. Y., $54,725.

Amawalk-Woods Bridge Road No. 769, Westchester County, 4.21 miles: The General Construction Co., Bridgeport, $31,486; Shanley-Morrissey Co., New York, $36,955; F. H. Fowler Construction Co., Mt. Kisco, N. Y., $42,147; John F. Creedon, New York, $32,710 Rowe Contracting Co., Melrose, Mass., $37,453; Bellew & Merritt, Tuckahoe, $33,094; McNamee & Rice, Rondout, $37,808; Ganung & Hoyt, Katonah, $41,496; Decicco Contracting Co., Larchmont, $27,297; John Twiname, Putnam, N. Y., $36,741; Malloy & Murray, Yonkers, $40,320; H. B. Sproul, Peekskill, $32,708; William F. McCabe, White Plains, $34,925.

Golden Bridge-Turk Hill Road No. 770,

Westchester County, 3.85 miles: Bellew & Merritt Co., Tuckahoe, $31,768; McNamee & Rice, Rondout, $37,076; John P. Creedon, New York, $32,159; Canung & Hoyt, Katonah, N. Y., $43,683; Rowe Contracting Co., Melrose, Mass., $36,446; F. G. Fowler Construction Co., Mt. Kisco, $40,806; John Twiname, Carmel, $34,232; Malloy & Murray, Yonkers, $37,159; Decicco Contracting Co., Yonkers, $26,882; Harvey B. Sproul, Peekskill, $30,060; W. F. McCabe, White Plains, $35,250; Shanley-Morrissey Co., New York, $35,212; A. D. Bridges Sons, Hazardville, Conn., $31,120.

Cooperstown-Three Mile Point Road No. 784, Otsego County, 3.12 miles: Spuyten Duyvil Construction Co., New York, $34,163; Alonzo Schaupp, Albany, $33,007; Elmore & Hamilton, Albany, $30,536; Hallinan Bros., Little Falls, N. Y., $39,080; Buckley Construction Co., Plattsburg, $36,163; D. I. Snell & Co., Canajoharie, $35,145; Newport Construction Co., Newport, $34,629; Malloy & Davis, Schenectady, $31,431; Delaware Construction Co., Sidney, N. Y., $41,174; John Harrigan, New York, $30,573; Shanley-Morrissey Co., New York, $34,349.

South Schenectady-Mariaville Road No. 788, Schenectady County, 7.32 miles (bids are for syenite, local and limestone, respectively): Morris Kantrowitz, Albany, $73,216, $60 411, $67,916; Buckley Construction Co., Plattsburg, $80,118, $69,102, $78,278; Malloy & Davis, Schenectady, $67,984, $57,904, $64,227; Chambers & Grady, Rochester, $89,924, $71,136, $89,924; Browne & Lowe, Schenectady, $77,972, $61,761, $71,410; Richmond F. Hudson, Melrose, Mass., $74,481, no bid, no bid; Casey & Murray, Rochester, $80,723, $64,026, $77,086.

Huntington-Amityville Road No. 794, Suffolk County, 10.14 miles: Casey & Murray, Rochester, $98,276; Fred T. Ley & Co., Springfield, Mass., $105,818; Long Island Construction & Supply Co., Long Island City, $96,766; F. J. Gallagher, Brooklyn, $100,306; John F. Creedon, New York, $89,556; Henry J. Mullen, Jamaica, L. I., N. Y., $87,376; Bellew & Merritt, Tuckahoe, $91,109; Robertson & Gerehart, Brooklyn, $89,934.

Jeffersonville - Kenoza Lake - Fosterdale Road No. 795, Sullivan County, 6.2 miles: Shanley-Morrissey Co., New York, $58,527; Joseph Walker, New Paltz, $52,589; Casey & Murray, Rochester, $70,251; Bellew & Merritt, Tuckahoe, $49,903; John F. Clancy, Astoria, L. I., N. Y., $58,568; Clinton Beckwith Co., Herkimer, N. Y., $60,507.

Greenville-Coxsackie Road No. 796 (Sec. 1), Greene County, 4.62 miles: Morris Kantrowitz, Albany, $41,342; Thomas O'Hern, Yonkers, $36,825; O'Connor & McEntire Co., New York, $42,784; Joseph Walker, New Paltz, $38,515; Newport Construction Co., Newport, N. Y., $40,660; John E. Consaulis, New York, $38,437; Clinton Beckwith Co., Herkimer, $39,902; Edward Uthe, Coeymans, N. Y., $38,079; Richmond F. Hudson, Melrose, Mass., $43,449; Shanley-Morrissey Co., New York, $44,813.

*NEWTON, N. J.—Bids are asked until noon, Dec. 17, by the Board of Chosen Freeholders for grading and macadamizing a section of public road in the Township of Andover, the Borough of Andover and the Township of Byram, a distance of about ten miles. Loren C. Cole is Dir. Bd.

HILLSDALE, N. J.—Bids will be received until Nov. 28 by the Township Committee, Albert Mohurking, Chn., for macadamizing and grading Yesler Way, Piermont, Fairview, Magnolia, Summit and Washington Aves., and Lawrence St., a total distance of 2.656 miles; also, same time and place, separate bids for grading and macadamizing 5.33 miles of streets here. H. G. Hering, Jr., is Township Engr. Advertised last week.

*CAPE MAY, N. J.—The contract for constructing 2.094 miles of gravel road known as Schellenger's Landing Road, bids opened Nov. 4, has been awarded to J. L. Clymer, Marshall and Berks Sts., Philadelphia, Pa., at $10,593. List of bidders noted last week.

WEEHAWKEN, N. J.—The city has let the contract for 7,000 sq. yds. of repressed paving brick to the LAYTON FIRE CLAY CO., of McKeesport, Pa.

CHARLEROI, PA.—HASTINGS, OWENS & PIPER, of this city, have been awarded the contract for paving Lincoln Ave.

The contract for the brick for this street was awarded to the MACK MFG. CO., Pittsburg, Pa.

DAWSON, PA.—The THOMAS SWEENEY CO., 4906 Cypress St., Pittsburg, Pa., has been awarded the contract for paving Howell St.

The contract for the stone curbing was awarded to LOUIS COSTA, Dickerson Run, Pa. The work is to be started at once, and completed by Jan. 1, 1909.

UNIONTOWN, PA.—Bids are asked until Nov. 25, by the State Highway Department, Harrisburg, Pa., for constructing 6,654 ft. of state road in South Union Township, and 26,100 ft. of road in Menallen Township.

LEMOYNE, PA.—The citizens on Nov. 3 voted to issue $15,000 of bonds for opening, grading and improving streets in this borough. Oscar Wolfensburger is Secy. Council.

CUMBERLAND, MD. — CHRISTOPHER ROEDER, of Cumberland, has secured the contract, at $4,144, for curbing and paving sidewalks on Springvale Ave.

ROANOKE, VA.—The Finance Committee of the City Council on Oct. 30 decided to recommend a bond issue of $600,000 for street improvements. W. B. Bates is City Engr.

CHARLOTTE, N. C.—The Charlotte Consolidated Construction Co. will expend about $20,000 in car-track improvements on South Tryon St. The center and short space on either side of the outside rails will be paved with vitrified brick.

COLUMBIA, S. C.—Bids are asked by Richland County until Nov. 23 for constructing concrete sidewalk and curbing around the county court-house. T. I. Weston is County Engr.

TAMPA, FLA.—The County Commissioners awarded the contract on Nov. 6 to BRYAN & McCONNELL for the construction of the Clearwater and Dunedin Road, at 45 cts. per sq. yd. for paving and 20 cts. per sq. yd. for grading.

COLUMBUS, MISS.—The city has awarded the contract to P. C. CAMPBELL, Columbus, for the construction of concrete sidewalk, about 33,000 ft.

CLEVELAND, TENN.—Mitchell, Minnis & Co., Birmingham, Ala., have been engaged by the city to prepare plans and specifications for the construction of sidewalks.

CHATTANOOGA, TENN.—The Board of Public Works, H. F. Van Dusen, Chn., has deferred action on bids received for brick paving on 3,500 ft. of roadway on East Main St. New bids will be asked.

CLINTON, KY.—The citizens on Nov. 3 voted to issue $15,000 of bonds for street improvements. W. T. Walker is City Clk.

EMINENCE, KY.—The citizens on Nov. 3 voted to issue $15,000 of bonds for the improvement of streets. F. S. Moody is City Clk.

NEWARK, OHIO.—Bids will be received until Nov. 23 by the County Commissioners for grading, macadamizing and draining 1,000 ft. of road in Lima Township.

AKRON, OHIO.—Bids will be received until Nov. 23 by the Board Public Service, Ray F. Hamlin, Secy., for paving a portion of Russell Ave.

HARTFORD CITY, IND. — CHARLES CLAME has been awarded a contract by the County Commissioners for constructing a macadamized road in Blackford County, at $12,403.

VERNON, IND.—Bids are asked by the Commissioners of Jennings County until 11 a. m., Dec. 7, for the construction of 2¾ miles of pike road in Vernon Township. I. L. Thomas is County Audr.

MADISON, IND.—Bids are asked by the Commissioners of Jeffersonville County until 1 p. m., Dec. 8, for the construction of 58,404 ft. of macadamized road in Lancaster Township, and for the construction of 6.04 miles of macadamized road in Smyrna Township. Gaylord F. Crozier is County Audr.

DELPHI, IND.—Bids are asked by the Commissioners of Carroll County until noon, Dec. 7, for the construction of two gravel roads in Democrat Township. M. G. Haun is County Audr.

MUNCIE, IND.—Bids are asked by the Commissioners of Delaware County until 10 a. m., Dec. 9, for the construction of the following gravel roads: Russey road in Pleasant Township; Zehner road in Delaware Township; Stephens road in Center Township; Payton road in Center Township; and the Shroyer road in Liberty Township. Joseph E. Davis is County Audr.

VINCENNES, IND.—Bids will be received by the Commissioners of Knox County until 2 p. m., Dec. 8, for the construction of 2,205 ft. of gravel roads in Vincennes Township, and for 1,300 ft. of gravel roads in Vincennes Township, known as the Hinkle road. John T. Scott is County Audr.

CORYDON, IND.—Bids are asked by the Commissioners of Harrison County until 2 p. m., Dec. 9, for the construction of a macadamized road in Spencer Township, and at 2.30 p. m., same date, for the construction of a gravel or macadamized road in Jackson Township. Frank E. Watson is County Audr.

LA FAYETTE, IND.—Bids will be received by the Commissioners of Tippecanoe County until 10 a. m., Dec. 9, for the construction of the Bender gravel road in Wabash Township. John P. Foresman is County Audr.

ELKHART, IND.—Bids are asked until 10 a. m., Nov. 25, by T. G. Wilkinson, City Clk., for paving South Main St. with sheet asphalt. A. M. Smith is City Engr.

DETROIT, MICH.—F. PORATH & SONS, 878 23th St., have secured the contract for paving with brick a portion of Michigan Ave., at $11,200. Bids were opened on Nov. 4. J. J. Haarer is Comr. Pub. Wks.

IOWA CITY, IOWA.—William Horrabin has submitted the lowest bid to the city for 5,000 yds. excavation and grading at the west approach of the park bridge, at 23 cts. Edwin J. Slater is City Clk.

OTTAWA, KAN.—The City Council on Oct. 28 awarded the contract for macadamizing 15,300 sq. yds. on Locust and Maple Sts. to RANSOM & COOK.

KANSAS CITY, MO.—The Board of Public Works on Oct. 28 adopted resolutions providing for paving Eighth, Wyoming, McCoy, Scarritt, South Benton and Seventh Sts., and constructing granitoid sidewalks on Mersington, Walrond, Harrison, Kensington, Fremont, Grand, Chelsea and Poplar Sts. J. L. Darnell is City Engr.

GURDON, ARK.—The city has awarded the contract to the GURDON BRICK CO., of Gurdon, for paving about ½-mile of brick sidewalks.

OKLAHOMA CITY, OKLA.—The city awarded the following contracts on Nov. 4 for street grading and paving: For asphalt pavement, CONWAY PAVING CO., 138 Washington St., Chicago, Ill., $217,150; PARKER-WASHINGTON CO., 4500 Duncan Ave., St. Louis, Mo., $418,820; and CLEVELAND-TRINIDAD PAVING CO., Cleveland, Ohio, $27,099; for alley brick pavement, JOSEPH A. HANNA CO., of Oklahoma City, about $1,800; for grading streets and alleys a distance of about 14 miles, BENNETT & ACKLIN CO., and J. R. ALLEY CO., at $70,000. Total cost, $813,879. W. C. Burke is City Engr.

PORTLAND, ORE.—THE WARREN CONSTRUCTION CO., 314 Lumber Exchange, Portland, has been awarded the contract for improving Union Ave., between Holladay Ave. and Alberta St., two miles long, at $160,775.

SAN MATEO, CAL.—The Board of Trustees has awarded the contract to the BARBER ASPHALT PAVING CO., Seventh and Hooper Sts., San Francisco, for paving a portion of San Mateo drive and a portion of Second Ave. John D. Morton is Clk., Bd.

SALT LAKE CITY, UTAH.—We are officially advised that all bids for curb and gutter extension No. 6, bids opened on Oct. 23, have been rejected by the Board of Public Works. Bidders noted last week. Louis C. Kelsey is City Engr.

BEAMSVILLE, ONT.—The Ontario Ry. Co. and Municipal Board has authorized this city to expend $11,000 for the construction of granolithic sidewalks.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

LUBEC, ME.—The Lubec Sardine Co. will erect a packing plant on its property on Water St., it is reported. It is probable that the plant will be operated by electricity. An addition will be made to the store house.

HAVERHILL, MASS.—Knipe Bros. manufacturers of men's shoes at Ward Hill, a suburb of this city, are preparing to enlarge their factory by adding 100 ft., the structure to be 50 ft. wide, and three stories high, to correspond with the present building. The new section is expected to be ready for occupancy in about two months.

ATHOL, MASS. — The Frederick H. Sprague Co., manufacturers of men's clothing, will build additional shop room. The company has decided to build at once an addition 100 × 30 ft. and two stories high. After the addition is built 50 more hands will be employed.

THORNTON, R. I.—An addition to the plant is contemplated by the management of the Victoria Woolen Mills at Thornton.

WATERBURY, CONN.—The Shoe Hardware Co., manufacturers of buckles, has taken out a permit for razing three old wooden buildings now occupied by it on Brown St. and their replacement by a factory structure of brick and stone.

OSWEGO, N. Y.—Erection of a plant is contemplated by the Ontario Knitting Co., a branch of the Utica Knitting Co., of Utica. A $300,000 mill is intended. Recently the capital stock of the concern was increased to $1,500,000.

PLATTSBURG, N. Y.—The Lozier Mfg. Co. will receive bids at once for a factory building for the manufacture of automobiles. The structure is to be of brick and mill construction and will cost about $40,000.

BUFFALO, N. Y.—The John R. Kein Mills will build a 1-story brick addition for furnace and press uses immediately, at Kensington Ave. and the Erie R. R. Cost, $10,000.

The Bergman Tool Co. will erect a 3-story reinforced-concrete factory building, 42 × 170 ft., at Niagara St. and Forest Ave., at once. The contract will be let by S. Bergman, Pres., 102 Seneca St., as soon as plans now being prepared are completed.

The Republic Metalware Co., 90 Alabama St., is having plans prepared and will let contract at once for a brick addition to its stamping works, 230 Clinton St.

A box factory of brick and frame construction will be built by Graves, Manbert, George & Co. at the foot of Hertel Ave., on the Erie Canal.

ELMIRA, N. Y.—We are officially advised that the contract for constructing a 2-story bakery, 38 × 60 ft., to be built for C. J. Hancock, has been awarded to CHARLES E. McCONNELL, of Elmira. Otis Dockstader, Robinson Bldg., Elmira, is Arch.

HOBOKEN, N. J.—Charles Fall, Arch., 100 14th St., Hoboken, has completed plans for a 5-story furniture factory building for Ferguson Bros., Eighth St., Hoboken.

RIVERSIDE, N. J.—The Weidmann Silk Dyeing Co., Fifth Ave., Paterson, N. J., will erect a dyeing plant at East Fifth St., Riverside. It will be one story high and will cover an area 400 × 150 ft., not including the machine shop and boiler house, to be erected in connection with the establishment. The cost is estimated at $100,000.

BRECKENRIDGE, PA.—A 1-story corrugated iron building is to be added to the plant of the Allegheny Steel Co., Farmers' Bank Bldg., Pittsburg, Pa. The structure will be 60 × 65 ft. The contract for the construction has been let to VOLLKOMMER & CO., Empire Bldg., Pittsburg.

SCOTTDALE, PA.—HUNKIN BROS., Cuyahoga Bldg., Cleveland, Ohio, have the general contract for the construction of a blowing engine building at Scottdale, for Corrigan, McKinney & Co., Perry-Payne Bldg., Cleveland. The buildings will measure 28 × 35 and 13 × 35 ft., respectively.

PHILADELPHIA, PA.—Hewitt, Stevens & Paiste, Archs., Bullitt Bldg., have prepared plans for a 4-story bookbinding plant for the Franklin Bindery Co., 215 Locust St.

PITTSBURG, PA.—The Pittsburg "Gazette-Times" states that W. E. Corey, Pres. U. S. Steel Corporation, has announced that it has been decided to erect a steel wheel plant in the Pittsburg district, to make improvements on the Schoen pressed steel wheel plant at McKees Rocks, lately acquired by the United States Steel Corporation, and to enlarge some of the departments of the mills at Homestead. The wheel plant will cost about $3,000,000; improvements at the Schoen plant will involve $1,500,000, and enlargements at the Homestead mills about $1,000,000, making a total expenditure of $5,500,000.

ZELIENOPLE, PA.—Plans have been prepared by the Iron City Sanitary Mfg. Co., 18 Wood St., Pittsburg, for a 1-story foundry building to be erected as an addition to its plant here.

SHAMOKIN, PA.—T... ducting a silk mill h... tract to the SHAMO... build a $20,000 exten... ing, near Edgewood Pa...

MIDDLETOWN, PA.— ...tory is to be built at ... Citizens of this town ... 000 towards the proje... Co., shoe manufacture... factory, will employ 2...

TARENTUM, PA.—C... of Pittsburg, has been ... pare plans for a 1-sto... rentum, for the Pittsb... Frick Bldg., Pittsburg, ... cently destroyed by fir...

John R. McGinley, ... and Julian Burdick, both ... the head of an unname... erect a plant near Tare... facture of various steel ... wire and nails. The c... its site, and will award ... erection of the plant ... equipment during the ... will be incorporated in ... laws of the State of Penn... will consist of open h... finishing mills.

WILMINGTON, DEL.— ... Sewer Department has de... application of the Harlan ... Corporation to close Justis ... corporation may construct ... plans call for shops to co... is intended to manufactu... cars of all kinds. When t... tion the company expects to ... to 1,000 additional men. ... planned improvements for ... department, and it is stated ... be 3,000 workingmen employed in the plant.

BALTIMORE, MD.—John ... Freund, Jr., Arch., 210 East Lexington St., is preparing plans for an addition to be built to the big bakery plant of William Freihofer, at Howard and Stockholm Sts. The designs provide for a 2-story brick building fronting 40 ft., with a depth of 175 ft., of mill construction, and fitted with the latest conveniences and appliances of a first-class bakery. The plant at present is one of the largest in the city. Local contractors are preparing estimates.

A brick bottling plant of steel construction, will be erected at the corner of Toone and Third Sts., Canton, by the George Gunther, Jr., Brewing Co. Otto G. Simonson, Arch., American Bldg., is preparing the plans.

NORFOLK, VA.—The Trexler Co., Harry C. Trexler, Pres., Allentown, Pa., has purchased 20 acres of land on Norfolk & Portsmouth Belt Line R. R. and will establish a lumber plant to cost about $300,000.

LA GRANGE, GA.—It is stated that Fuller E. Calloway, of La Grange, is interested in the Manchester Cotton Mills to be built at a cost of $250,000.

EWING, GA.—C. M. Council, of Americus, Ga., and others will establish a sawmill. As contemplated, the plant and machinery will cost about $50,000 and will have daily capacity of from 50,000 to 75,000 ft.

CORDELE, GA.—H. L. Mize, of Americus, Ga., has purchased plant of Cordele Ice Co., it is stated. New buildings will be erected to replace present structures and the entire plant re-equipped. The equipment will include two 125-HP. boilers. Capacity of plant to be 30 tons daily. Cost, about $35,000. Mr. Mize contemplates establishing cold-storage warehouse.

ST. AUGUSTINE, FLA.—The Sola-Martinez-Carcaba Co. has let contract to B. E. PACETTI & SON for a 3-story and basement brick cigar factory building. Estimated cost, $15,000. Frederick Hendricks prepared the plans.

GADSDEN, ALA.—The Alabama Consolidated Coal & Iron Co. intends to erect a steel and wire mill in this city. Joseph H. Hoadley is Pres.

NEW ORLEANS, LA.—The International Car Co. has purchased 37 acres of land as site for the proposed plant and will arrange to erect buildings, 80 × 1,200 ft., of steel and corrugated iron. Plans and specifications are being prepared and machinery is being selected. This company has been incorporated with a capital stock of $350,000, for building and repairing cars, locomotives, etc., and its equipment will include electric motor driven machinery for wood and iron working, etc. C. A. Ralston, of Ralston & LeBaron, Chicago, Ill., is Pres.; A. T. LeBaron, 1029 Maison Blanche, New Orleans, is Gen. Mgr.

LOUISVILLE, KY.—The Bradford Worsted Mills Co. has been recently incorporated under the laws of Kentucky with a capital of $50,000. The officers are Philip S. Tuley, Pres.; Thomas Williams, Vice-Pres., and W. M. Shallcross, Secy. and Treas. The mill will have a capacity of 3,000 spindles and necessary machinery to make all kinds of worsted yarns for hosiery and dress goods in single and two-ply up to No. 40s. The contract for entire equipment of worsted machinery was placed with EDWARD JEFFERSON & BRO., 127 South Second St., Philadelphia, Pa.

NEW SALISBURY, OHIO.—A. G. White, of Toronto, Ohio, is preparing plans for a 3-story sewer pipe factory, 242 × 86 ft., at New Salisbury, for the Ohio Coal & Coke Co., Toronto.

NORWOOD (Cincinnati post-office), OHIO.—The Pfau Mfg. Co., 528 Reading Road, Cincinnati, has had plans prepared by Harry Hake, Arch., Union Trust Bldg., Cincinnati, for a 4-story building to be erected at Norwood. Cost, $50,000.

MAGNOLIA, OHIO.—Plans are being prepared for the locomotive shops to be erected at Brewster, a suburb, by the Wheeling & Lake Erie R. R. Co. The company expects to complete these plans and arrange work of construction of these buildings and the installation of the usual machinery to care for approximately 300 locomotives, beginning

work the early part of next year. Brewster is located at the junction of the Cleveland & Zanesville Division and the Toledo & Pittsburg Division. T. Douglas, Jr., is Ch. Engr.; B. A. Washington is Receiver, both at Perry-Payne Cleveland.

CLEVELAND, OHIO.—B. W. Corning, Arch., Schofield Cleveland, let general contract for a 2-story WEBSTER & NEWMAN public Store & building for the Co. Cost, $10,000.

TOLEDO, OHIO.—The Hull Bros'. Umbrella Co., 344 Su St., has purchased from Theodore B. A & Co., the old DeVeaux property, now as the Reed property, at 1451 Summit between Bush and Magnolia Sts. The has a frontage of 155 ft. on Summit St with a depth of 331 ft. on Magnolia St., running through to Superior St. The company will tear down the old residence buil on the property and erect a 1-story um factory structure.

LOCKLAND, O. (Cincinnati, Ohio, postoffice).—The Paper Co. intends to rebuild the plant lately destroyed by fire. The new plant will be larger than the previous one. G. W. Drach, Union Trust Bldg., Cincinnati, Ohio, is Arch.

INDIANAPOLIS, IND.—Plans are being prepared by Herbert L. Bass & Co., Archs., Commercial Club Bldg., Indianapolis, for a 3-story building for the Climax Coffee & Baking Powder Co., 523½ East Washington St. Cost, $35,000.

BLOOMINGTON, IND.—The Indiana Creosoting Co. will receive bids, as soon as plans are completed, for the erection of an addition to its plant. Estimated cost, $100,000. J. H. Durham, Gen. Mgr.

SPRINGFIELD, ILL.—George H. Helmle, 524 North Fifth St., Springfield, Arch., is preparing plans for a brick factory building for the Springfield Wire Screen Co., Robert Smillie, Proprietor, 1001 East Adams St.

CHICAGO, ILL.—It is stated that S. N. Crowen, Arch., Borland Bldg., Chicago, has prepared plans for a $60,000 factory and warehouse, to be erected by the Lindsay Light Co., 195 Michigan Ave.

Morris & Co., packers, have had plans prepared for a fireproof cold storage plant to be erected at 44th and Loomis Sts. at an estimated cost of $750,000.

JOCKO, MONT.—Bids are asked by C. F. Larrabee, Acting Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C., until 2 p. m., Dec. 9, for furnishing materials and labor necessary to construct and complete a flour and sawmill at Ronan subagency, Flathead, Mont., in accordance with plans, specifications and instructions to bidders, which may be examined at the office of Indian Affairs, Washington, D. C., the office of "Pacific Builder and Engineer," Seattle, Wash.; U. S. Indian warehouses, Chicago, St. Louis, Omaha, New York and San Francisco; Builders' and Traders' Exchanges, at Minneapolis, Omaha and St. Paul; Northwestern Manufacturers' Association, St. Paul, and at the agency. Samuel Bellew is U. S. Indian Agent, Jocko, Mont.

KANSAS CITY, MO.—A glass and steel building will be erected on the corner of Twelfth and Walnut Sts., by the Grand Pants Co., 12 East Twelfth St. The building probably will be six stories in height, of steel construction, with entire glass front and sides. The lot has a frontage of 38½ ft. on Twelfth St. and 80 ft. on Walnut St.

ST. LOUIS, MO.—According to the St. Louis "Globe-Democrat," the Champion Shoe Machinery Co., Channing and Franklin Aves., St. Louis, will erect on the north side of Forest Park Boulevard, west of Spring Ave., a plant that will have four times the capacity of its present factory at Channing and Franklin Aves. The structure will be concrete and will have a ground area of 150 × 200 ft. It will have two stories. The plans are almost completed, and bids will be asked for in a few days. The work of excavating will begin this week. J. B. Dobyne is Pres. The site for the factory is in the new manufacturing district and close to railroads.

Plans are being prepared by L. Pfeiffenberger & Sons, Archs., First National Bank Bldg., East St. Louis, Ill., for a 1-story factory building to be erected in St. Louis, Mo., at $4,000.

PARIS, TEX.—The Paris Box & Mfg. Co., H. M. Cuiston, Pres., recently incorporated to establish a box factory, will erect a wood structure, 112 × 90 ft., of mill construction, to cost $2,500. The company will install box-working machinery to cost $15,000. Daily capacity boxes, 25,000 ft.

BONHAM, TEX.—We are officially advised that R. E. Medford & Co. will erect and equip an ice plant here. The building will be of mill construction and will cost $10,000. Contracts will be let in March. The building will be 2½ stories high and will be of frame construction.

LAURELIA, TEX.—Hilgard Lumber Co., of Houston, Tex., E. R. Wicks, Pres., will rebuild plant recently burned at Laurelia. It will erect planing mill and lumber sheds to cost $5,000, of mill construction. The company will ask bids on equipment, including planers, engines, tools, etc., to cost from $10,000 to $12,000. Capacity of plant, about 70,000 ft. daily, yellow pine lumber.

LAWTON, OKLA.—The Lawton Sash & Door Co., recently incorporated, will erect and equip buildings for manufacturing sash and doors and general mill work. The main structure will be 48 × 100 ft., two stories, mill construction, and will cost $6,000. Bids for machinery to cost $10,000 will be received about Dec. 1. G. H. Block is Pres.; R. F. Chamberlain, Secy.; J. F. Tedford, Treas. The architect and engineer have not been engaged.

SPOKANE, WASH.—The contract has been awarded to the PETTIFER CONSTRUCTION CO. for a laundry building for the Peerless Laundry. Laundry machines will be located in the basement of the building, which will be 70 × 12 ft., 25 ft. high, with one story.

Harry Hayward, C. H. Larkin and W. J. Davenport are interested.

MIDWAY, CAL.—Charles E. Shattuck, Arch., Mason Bldg., Los Angeles, has prepared plans for a group of buildings to be built here for the Midway Oil Co.

SAN FRANCISCO, CAL.—Press reports state that the plant of the Union Iron Works Co. is to be enlarged at once. The offices of the company are at the Flood Bldg., San Francisco.

SAN BERNARDINO, CAL.—The construction of the Arrowhead brewery will cost about $250,000, and the building of plant will start soon. C. M. Gaylord, of Los Angeles, Arch. The site is on main line of Atchison, Topeka & Santa Fe Ry. R. J. Ochs, of this city, is Pres.; E. A. Levereaux is Vice-Pres.; A. J. Gabel is Secy., and J. W. Walde is Treas.

TORONTO, ONT.—Plans for the erection of a 2-story brick laundry building, of mill construction, estimated to cost $6,000, have been prepared by J. A. Cowan, 65 Adelaide St., East.

A plant will be erected in this city by the Monarch Brass Works, whose plant was burned out at Port Colborne recently. G. T. Clarkson, Toronto, is Mgr. of the Monarch Brass Mfg. Co.

TRENTON, N. S.—Plans are being prepared for the reconstruction of Humphrey Bros.' glass factory, destroyed by fire recently.

LOS ANGELES, CAL.—The Golden State Portland Cement Co., with offices in the Citizens' National Bank Bldg., is having the foundation work for its cement factory buildings put in. The company is now receiving bids for the structural steel frames for the various buildings to be erected at their quarries at Oro Grande. The present designs are for a 700-bbl. mill, which will be increased to a 2,800-bbl. plant. The buildings will cover about five acres.

HAMILTON, ONT.—Bellinger Bros., Engrs., Pittsburg, Pa., have made the plans and have secured the general contract for a brewery for the People's Brewery, Ltd., Hamilton. Estimated cost, $150,000.

MEXICO CITY, MEX.—At an estimated cost of $2,000,000 the Cia. Mexicana de Cemento de Portland, or Portland Cement Co. of Mexico, has undertaken the construction of a plant at Dublan, which plant is to operate on the "dry" system, with all rotary kilns and an output of approximately 1,000 bbls. per day. The Portland Cement Co. is a branch of the Cia. Bancaria de Obras y Bienes Raices.

MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—Items regarding irrigation, canal projects, etc., will be found under Water Supply—Irrigation.

LEVEE.—Waco, Tex.—Bids are asked by the Levee Board until Nov. 19 for construction of levee in East Waco.

DRAIN.—Sibley, Iowa.—Bids will be received on Nov. 23 for constructing drain in Drainage District No. 8. V. A. Burley is County Audr.

LEVEE.—North Topeka, Kan.—Bids will be received until 2 p. m., Nov. 21, by the North Topeka Drainage Bd. for construction of levees. J. B. Billard, Pres.

HOSE WAGONS.—New York, N. Y.—Bids are asked until 10.30 a. m., Nov. 25, by Nicholas J. Hayes, Fire Comr., for furnishing three extra large hose wagons.

CUT-OFF.—Columbus, Ind.—Bids will be received until Nov. 21 by the Commissioners of Bartholomew County for constructing a cut-off of Flat Rock River. J. M. Davis is County Audr.

DREDGING.—Savannah, Ga.—Bids will be received by Col. Dan. C. Kingman, Corps Engrs., U. S. A., until noon, Dec. 9, for dredging in waterway between Savannah and Fernandina, Fla.

(Continued on page 182.)

CONTRACT PRICES.

[Where * precedes item under Contract Prices the work was advertised in Engineering News.]

SANITARY SEWERS.—Hope, Ark.—Itemized bids were received as follows on Oct. 6 by the Board of Sewer Commissioners, Improvement District No. 1, for furnishing material and constructing a system of sanitary sewers: (A) Newman Sewer Construction Co., Evansville, Ind., $69,930; (B) J. J. Dunegan, Shenandoah, Iowa, $69,782; (C) G. Munz, Texarkana, Tex., $65,454; (D) Standard Construction Co., Chicago, Ill., $86,999 (E) Geisel Construction Co., St. Louis, Mo., $72,911; (F) W. T. Riley Construction Co., St. Louis, Mo., $84,074; (G) Pouncey Kaumer & Construction Co., Helena, Ark., $70,145; (H) Monahan Bros., Joliet, Ill., $77,575; Charles F. Derr, Oklahoma City, Okla., $73,756, (J) H. C. Gass, Belleville, Ill., $78,839; (K) Bosler & Flynn, Chattanooga, Tenn., $76,561; (L) Bosh & Gray, Joplin, Mo., $65,240; (M) Nick Peay, Little Rock, Ark., $76,764 (not including excavation); (N) Irwin Bros., New Orleans, La., $81,784; (O) Northern Alabama Construction Co., Riverton, Ala., $83,532; (P) T. M. Bermer, Marion, Ind., $83,584; (Q) HAMILTON BROS. CONSTRUCTION CO., Taylorville, Ill., $62,111 (awarded contract); (R) W. W. Cook & Sons, Junction City, Kan., $68,299. J. A. Omberg, Jr., Godwyn Bldg., Memphis, Tenn., is Engr.

		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
14,500 ft.	6" pipe, 4' to 6'	$0.28	$0.29	$0.26	$0.40	$0.30	$0.35	$0.30	$0.30	$0.33
2,300 "	6" " 6' " 8'	.29	.39	.30	.49	.40	.38	.36	.35	.38
400 "	6" " 8' " 10'	.31	.49	.34	.68	.50	.50	.45	.40	.44
180 "	6" " 10' " 12'	.33	.59	.38	.78	.60	.60	.50	.80	.57
33,400 "	8" " 4' " 6'	.39	.35	.34	.47	.40	.50	.36	.38	.39
11,200 "	8" " 6' " 8'	.40	.45	.39	.63	.45	.57	.42	.43	.44
4,000 "	8" " 8' " 10'	.42	.55	.43	.82	.55	.66	.48	.58	.50
815 "	8" " 10' " 12'	.46	.65	.47	.91	.70	.75	.55	.88	.63
4,900 "	10" " 4' " 6'	.47	.42	.42	.52	.45	.60	.45	.44	.47
5,100 "	10" " 6' " 8'	.48	.52	.46	.68	.50	.65	.50	.49	.56
2,500 "	10" " 8' " 10'	.50	.62	.50	.88	.60	.70	.57	.64	.63
600 "	10" " 10' " 12'	.52	.72	.55	.93	.75	.80	.65	.94	.77
330 "	10" " 12' " 14'	.62	.82	.60	1.11	.90	.95	.90	1.19	.90
500 "	10" " 14' " 16'	.72	.92	.80	1.34	1.10	1.15	1.30	1.54	1.10
500 "	10" " 16' " 18'	.82	1.02	1.00	1.63	1.30	1.25	1.50	2.04	1.20
500 "	10" " 18' " 20'	.92	1.12	1.25	1.98	1.50	1.35	2.00	2.80	1.40
200 "	10" " 20' " 22'	1.02	1.22	1.75	2.28	1.75	1.60	3.00	3.30	1.60
3,800 "	12" " 4' " 6'	.54¾	.49	.51	.58	.50	.65	.50	.50	.70
400 "	12" " 6' " 8'	.56	.59	.56	.75	.65	.68	.60	.55	.78
2,100 "	12" " 8' " 10'	.58	.69	.61	.93	.70	.78	.65	.70	.85
2,700 "	12" " 10' " 12'	.59¾	.79	.67	1.10	.75	.90	.70	1.00	1.00
400 "	12" " 12' " 14'	.69¾	.89	.85	1.25	.90	1.00	1.00	1.25	1.13
550 "	12" " 14' " 16'	.79¾	.99	1.05	1.50	1.20	1.25	1.40	1.60	1.35
2,100 "	15" " 4' " 6'	.63½	.65	.70	.79	.75	.75	.67	.69	.80
1,200 "	15" " 6' " 8'	.64½	.75	.76	.90	.80	.83	.72	.74	.90
1,800 "	15" " 8' " 10'	.66½	.85	.83	1.10	.90	.90	.80	.89	1.00
600 "	15" " 10' " 12'	.68½	.95	.95	1.30	1.10	1.00	.85	1.09	1.15
400 "	15" " 12' " 14'	.79½	1.05	1.05	1.40	1.25	1.20	1.20	1.44	1.28
1,000 "	15" " 14' " 16'	.89½	1.15	1.30	1.70	1.40	1.35	1.50	1.79	1.50
900 "	15" " 16' " 18'	.99½	1.25	1.75	2.00	1.80	1.60	1.80	2.29	1.60
860 "	15" " 18' " 20'	1.09½	1.35	2.00	2.35	1.80	1.70	2.40	3.04	1.90
40	flush tanks	46.75	70.00	60.00	70.00	60.00	60.00	60.00	75.00	65.00
135	manholes	22.25	35.00	35.00	28.00	45.00	35.00	32.50	30.00	32.50
60	each additional foot	3.00	4.00	5.00	3.00	4.50	2.50	3.00	3.25	4.00
	Septic tank (lump sum)	11,118.00	4,500.00	3,594.80	5,000.00	3,920.00	6,830.00	3,500.00	4,060.00	3,400.00
2,800	cu. yds. filtering material	2.50	2.50	2.50	2.50	2.00	1.90	2.20	2.50	2.00
600	cu. yds. earth excavation	.25	.35	.20	.30	.40	.75	.40	.40	.30
1,600	ft. 6" drain tile	.15	.10	.18	.15	.08	.20	.15	.10	.20
	Pumping station:									
70	cu. yds. excavation	.35	.75	.25	.30	.85	.75	.40	.40	.30
10	M. brick	15.00	18.00	14.00	20.00	19.00	18.00	15.00	12.00	20.00
6	cu. yds. concrete	10.00	14.00	9.00	12.00	9.00	20.00	10.00	12.00	12.00
1,680	ft. 8" cast-iron pipe (2' to 4')	.65	.85	.95	.60	.92	1.50	1.10	1.00	1.60
	Total	$69,930	$69,782	$66,454	$86,999	$72,911	$84,074	$70,145	$77,573	$73,756

		(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)
14,500 ft.	6" pipe, 4' to 6'	$0.34	$0.27	$0.29	$0.35	$0.28	$0.30	$0.35	$0.24	$0.26
2,300 "	6" " 6' " 8'	.41	.39	.38	.40	.30	.38	.42	.26	.33
400 "	6" " 8' " 10'	.61	.47	.56	.60	.45	.53	.54	.28	.45
180 "	6" " 10' " 12'	.86	.63	.68	.70	.55	.73	.75	.40	.60
33,400 "	8" " 4' " 6'	.40	.39	.35	.40	.39	.36	.45	.29	.35
11,200 "	8" " 6' " 8'	.47	.45½	.40	.50	.45	.44	.54	.31	.41
4,000 "	8" " 8' " 10'	.67	.57¾	.58	.60	.55	.58	.67	.34	.52
815 "	8" " 10' " 12'	.92	.75¾	.70	.75	.70	.79	.80	.40	.67
4,900 "	10" " 4' " 6'	.46	.48	.43	.45	.50	.45	.50	.42	.43
5,100 "	10" " 6' " 8'	.53	.56	.52	.60	.55	.52	.60	.47	.51
2,500 "	10" " 8' " 10'	.73	.68	.71	.70	.65	.70	.77	.49	.60
600 "	10" " 10' " 12'	.98	.81	.90	.85	.80	.90	.92	.62	.75
330 "	10" " 12' " 14'	1.48	1.08	.95	1.15	.95	1.20	1.15	.78	.88
500 "	10" " 14' " 16'	1.78	1.33	1.05	1.35	1.20	1.70	1.40	.93	1.00
500 "	10" " 16' " 18'	2.28	1.66	1.25	1.75	1.65	2.00	1.85	1.07	1.15
500 "	10" " 18' " 20'	2.78	2.02	1.30	2.20	1.80	2.50	2.30	1.19	1.40
200 "	10" " 20' " 22'	3.28	2.20	1.35	2.50	2.00	3.00	2.75	1.40	1.60
3,800 "	12" " 4' " 6'	.51	.61	.50	.50	.55	.54	.60	.53	.53
400 "	12" " 6' " 8'	.58	.71	.60	.62	.74	.63	.75	.53	.59
2,100 "	12" " 8' " 10'	.78	.84	.78	.75	.89	.82	.90	.55	.70
2,700 "	12" " 10' " 12'	1.03	1.03	.86	.90	1.19	1.05	1.15	.69	.85
400 "	12" " 12' " 14'	1.53	1.22	1.23	1.10	1.25	1.35	1.35	.85	.98
550 "	12" " 14' " 16'	1.83	1.48	1.25	1.40	1.35	1.80	1.75	1.00	1.10
2,100 "	15" " 4' " 6'	.64	.75	.63	.60	.75	.80	.76	.66	.73
1,200 "	15" " 6' " 8'	.71	.87	.73	.72	.90	.91	.86	.68	.80
1,800 "	15" " 8' " 10'	.91	1.04	.91	.85	1.10	1.12	1.00	.70	.90
600 "	15" " 10' " 12'	1.16	1.28	1.18	1.00	1.50	1.45	1.28	.83	1.05
400 "	15" " 12' " 14'	1.66	1.51	1.20	.20	1.65	1.80	1.45	1.00	1.20
1,000 "	15" " 14' " 16'	1.96	1.69	1.25	1.50	1.75	2.30	1.80	1.17	1.30
900 "	15" " 16' " 18'	2.46	2.02	1.40	2.00	1.80	2.70	2.10	1.35	1.45
860 "	15" " 18' " 20'	2.96	2.41	1.40	2.50	2.00	3.45	2.80	1.40	1.80
40	flush tanks	50.00	65.00	54.00	55.00	55.00	75.00	60.00	52.00	58.00
135	manholes	33.00	30.00	27.00	40.00	38.00	47.50	37.00	32.00	30.00
60	each additional foot	5.00	3.00	3.00	4.00	3.25	4.00	6.00	5.00	3.00
	Septic tank (lump sum)	3,885.50	4,250.00	2,875.00	....	5,800.00	3,400.00	3,750.00	3,765.00	2,900.00
2,800	cu. yds. filtering material	2.00	2.25	1.75	2.00	3.50	2.50	2.25	3.00	•2.50
600	cu. yds. earth excavation	.25	.45	.15	.50	.40	.50	.40	.40	.40
1,600	ft. 6" drain tile	.10	.15	.06½	....	.12	.10	.07½	.20	.20
	Pumping station:									
70	cu. yds. excavation	.50	....	.40	....	.50	1.50	.60	.40	.75
10	M. brick	12.00	15.00	11.50	....	22.00	15.00	18.00	2.00	18.00
6	cu. yds. concrete	12.00	15.00	8.00	....	25.00	10.00	12.00	12.00	10.00
1,680	ft. 8" cast-iron pipe (2' to 4')	1.00	1.00	.68	....	.93	.90	1.00	.71	1.00
	Total	$78,839	$76,561	$65,240	$70,674	$81,784	$81,532	$83,584	$62,111	$68,299

INTERCEPTING SEWER.—Elizabeth, N. J.—Bids were received by N. K. Thompson, Street Comr., on Nov. 2, for the construction of an intercepting sewer. W. H. Luster, Jr., is City Surv. Itemized bids were as follows: (A) Joseph Puglia; (B) the Harrison Construction Co., 857 Broad St., Newark; (C) A. E. Sanford Co., Hoboken, N. J.; (D) Wade & Callahan; (E) Wm. J. McCloud & Co., Elizabeth, N. J.; (F) Thos. H. Riddle, New Brunswick, N. J.; (G) Gore-Meenan Co. (rejected as bid was defective).

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Main Trunk Sewer.							
2,500' 44"—8' to 13' deep	$9.88	$7.00	$8.50	$6.48	$5.99	$8.20	$6.70
1,140' 42"—4' to 11'	8.46	6.00	4.75	6.21	5.08	7.50	6.60
350' 40"—Av. 16'	11.28	10.75	10.00	10.50	10.00	14.00	10.20
1,000' 38"—12' to 16'	10.74	9.55	8.75	9.26½	8.00	10.00	8.60
1,300' 38"—16' to 25'	13.95	13.50	13.00	10.33	10.15	12.50	10.70
700' 38"—16'	10.53	11.55	10.25	10.77½	9.00	9.50	9.20
900' 36"—15' to 24'	11.70	11.80	10.00	11.04	10.86	12.00	8.90
500' 34"—16' to 24'	12.05	11.25	10.00	12.06	9.40	15.00	8.20
2,150' 32"—16' to 25'	10.87	10.50	10.00	12.38	11.00	10.50	8.00
1,200' 30"—25'	12.63	12.90	11.00	13.07	11.33	11.50	7.70
250' 30"—17' to 24'	10.57	12.70	11.00	12.23	11.77	11.50	7.00
250' 28"—17' to 24'	9.59	12.19	11.00	12.10	12.17	11.50	6.50
200' 28"—24'	11.08	13.80	12.00	13.07	13.94	13.00	6.90
100' under river steel	11.00	20.00	25.00	14.22	25.00	45.00	20.80
2 special manholes	75.00	125.00	120.00	126.00	100.00	450.00	130.20
11 manholes, 6' to 12'	50.00	48.00	45.00	50.50	40.00	54.00	63.10
9 manholes, over 12' to 14'	60.00	55.00	60.00	58.20	55.00	78.00	77.20
9 manholes, over 14' to 17'	80.00	65.00	65.00	72.75	65.00	90.00	90.00
7 manholes, over 17' to 20'	90.00	75.00	76.00	89.25	75.00	108.00	102.20
11 manholes, over 20' to 23'	100.00	88.00	85.00	104.00	80.00	132.00	115.00
7 manholes, over 23' to 25'	120.00	100.00	95.00	115.50	90.00	144.00	123.00
100' 18" pipe	.95	5.25	4.75	4.81	5.00	6.00	2.30
290' 10" pipe, 16' deep	1.00	3.25	3.50	2.35	3.00	4.00	1.75
25' 6" pipe	.35	1.00	1.50	1.20	1.50	1.00	.75
100' 6' pipe	2.75	4.50	5.25	3.00	5.00	1.00	.70
15' 4" pipe	1.92	3.00	5.00	1.90	5.00	1.00	.70
260' 8" pipe, 17' deep	1.80	4.50	5.25	2.42½	4.00	4.00	1.10
25' 4" pipe	1.72	3.50	5.00	1.90	5.00	1.00	.70
25' 4" pipe	1.72	3.00	5.00	1.70	5.00	1.00	.70
135' 6" pipe, 11' deep	.81	1.00	2.50	2.18¼	2.00	2.00	.70
20' 4" pipe	1.50	3.00	5.00	1.25	5.00	1.00	.70
70' 6" pipe	2.00	3.50	5.00	2.05	5.00	1.00	.70
60' 6" pipe	1.50	2.50	3.00	2.05	2.00	1.00	.70
368' 12" pipe, 16' deep	1.70	3.00	4.00	2.25	3.00	2.00	2.10
50' 10" pipe	2.00	2.00	2.50	1.80	2.00	1.00	.90
1 15" gate valve	310.00	100.00	75.00	75.00	80.00	65.00	115.00
1 36" gate valve	675.00	500.00	500.00	550.00	550.00	575.00	290.00
30' 4" pipe	1.00	1.50	1.50	3.35	1.25	1.00	.70
90' 6" pipe	1.00	1.50	1.50	.60	1.00	1.00	.70
200' 4" pipe	.80	1.50	1.50	.62	1.00	2.00	.70
230' 12" pipe, 10' to 17' deep	1.55	2.25	2.00	2.55	2.25	3.00	2.30
South St. and Fourth Ave. lateral	147,241	139,752	130,294	136,063	125,660	147,135	111,200
1,300' 12" pipe, 12' deep	1.30	1.50	2.10	1.39	1.75	3.00	1.70
370' 15" pipe, 13' deep	1.50	2.00	4.30	1.95	4.00	3.50	2.20
108' under river steel	8.50	15.00	15.00	11.85	11.00	45.00	6.90
80' 10" pipe	.75	2.00	2.00	.98	1.50	1.00	.90
25' 8" pipe	.78	1.50	2.00	1.15	1.50	1.00	.90
6 manholes, 12' deep	45.00	50.00	50.00	50.50	55.00	72.00	75.00
2 special manholes	130.00	100.00	100.00	118.50	110.00	400.00	115.00
South Side lateral	3,772.50	5,007.50	6,651.00	4,455.45	5,650.50	11,392.00	4,544.70
700' 15" pipe, 10' to 27' deep	4.00	6.00	6.90	3.85	6.00	4.00	3.00
380' 15" pipe, 23' to 27' deep	4.00	6.50	7.00	3.50	6.00	3.50	3.20
900' 12" pipe, 16' to 23' deep	3.00	4.75	6.35	2.50	5.00	3.00	2.30
340' 12" pipe, 19' deep	3.00	4.75	5.70	2.50	4.34	2.50	2.30
600' 12" pipe, 11' to 19' deep	1.60	3.50	4.90	1.55	3.69	2.00	2.00
650' 12" pipe, 19' to 21' deep	3.00	4.50	5.90	3.08	4.50	2.00	2.30
487' 10" pipe, 16' to 20' deep	2.00	4.00	5.00	2.65	4.35	2.00	1.70
2 manholes, 11'	50.00	45.00	50.00	50.50	54.00	65.00	69.00
6 manholes, 16' to 19'	85.00	70.00	75.00	72.50	77.00	90.00	96.00
6 manholes, over 19' to 24'	90.00	90.00	95.00	107.00	92.00	110.00	112.00
4 manholes, over 24' to 28'	125.00	105.00	100.00	120.00	107.00	150.00	130.00
80' 6' pipe	1.15	1.50	2.00	1.20	1.50	1.00	.70
25' 8" pipe	1.10	1.75	2.50	2.16	2.50	1.00	.80
25' 6" pipe	.75	1.50	1.50	.82	1.00	1.00	.70
25' 6" pipe	.93	1.50	1.70	1.03	1.50	1.00	.70
300' 10" pipe, 14' to 20'	2.50	4.00	5.40	3.40	4.34	1.00	2.00
60' 6" pipe	.60	1.50	2.00	2.45	3.25	1.00	.70
40 drip pails	2.50	2.25	2.00	.97	2.50	8.00	6.00
15,000 cu. yds. rock excavation	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Inspector, days	[1]750.00	[2]975.00	[3]1,050.00	[4]900.00	[5]900.00	[6]1,500.00	[7]1,500.00
Total brick sewer	185,055	186,977	183,674	174,523	173,946	192,626	148,520
Total Parmley Block	147,096	180,714	177,168	174,523	171,297	180,126	128,520
1-3-6 concrete in place, per cu. yd.	6.50	8.00	10.00	8.50	10.00	8.00	7.00
Brick masonry in place, per cu. yd.	12.25	13.00	13.00	14.50	14.00	9.00	13.00
Spruce timber, wedges, etc., per M.	50.00	45.00	60.00	50.00	50.00	60.00	50.00
Spruce timber sheathing, per M.	41.00	40.00	40.00	39.00	38.00	35.00	40.00
Tarred paper, per sq. yd.	.07	1.00	1.00	.90	1.25	1.50	2.00
44" concrete steel sewer, per lin. ft.	9.50	7.25	8.50	10.00	12.00	8.20	5.50
42" concrete steel sewer, per lin. ft.	6.75	6.25	6.50	10.00	11.00	7.50	5.40
1-2-4 concrete in place, per cu. yd.	7.50	10.00	15.00	10.00	13.50	12.00	12.00
Steel reinforcement, per lb.	.06	.05	.05	.05	.05	.10	.05
Poxite joints, each	.20	.25	.25	.35	.30	2.00	.70
PARMLEY BLOCK.							
2,500' 44"—8' to 13' deep	6.94	6.65	5.90	6.48	5.50	7.20	5.00
1,140' 42"— 4' to 11' deep	5.82	5.70	4.25	6.21	4.00	6.50	4.90
350' 40"—16' deep	8.96	10.25	9.50	10.50	9.20	13.00	8.70
1,000' 38"—12' to 16' deep	8.40	9.05	8.25	9.26½	8.50	9.00	6.80
1,300' 38'—16' to 25' deep	10.36	12.85	12.50	10.33	12.35	11.50	9.00
700' 38'—16' deep	7.05	11.00	9.75	10.77½	10.60	8.50	8.70
900' 36"—15' to 24' deep	8.34	11.20	9.50	11.04	10.40	11.00	7.10
500' 34"—16' to 24' deep	8.70	10.70	9.50	12.66	10.45	14.00	6.60
2,150' 32"—16' to 24' deep	7.73	10.00	9.50	12.38	10.00	9.50	6.40
1,200' 30"—25' deep	9.10	12.25	10.50	13.01	10.35	10.50	6.00
250' 30"—17' to 24' deep	8.40	12.05	10.50	12.23	10.25	10.50	6.00
250' 28"—17' to 24' deep	7.84	11.60	10.50	12.10	10.65	10.50	5.00
200' 28"—24' deep	8.57	13.10	11.50	13.07	12.00	12.00	5.40
Total for Parmley Block	99,510	120,727	108,474	124,842	109,965	117,867	80,501
Regular bid for all other work	47,586	59,987	68,674	49,680	61,332	62,259	48,019
Total, including inspector	$147,096	$180,714	$177,148	$174,522	$171,297	$180,126	$128,520

[1]250 days, [2]325 days, [3] 350 days, [4]300 days,, [5]300 days, [6]500 days, [7]500 days.

***SEWAGE DISPOSAL SYSTEM.**—Wyoming, Ohio.—Bids were received on Nov. 4 by W. A. Clark, Village Clk., for the construction of a sewage disposal plant, and about 22,569 ft. of sanitary sewers, with the necessary appurtenances. The Riggs & Sherman Co., Engrs., Toledo, Ohio. Bids in detail were as follows—(A) Scott & Walker, Cincinnati; (B) Thos. P. Strack, Cincinnati; (C) Evan Evans, Cincinnati; (D) Kirchner Construction Co., Cincinnati; (E) Walter S. Hollaender, Cincinnati; (F) Bosler & Flynn, Chattanooga, Tenn.; (G) C. S. Lambie Co., Pittsburg, Pa.; (H) T. J. Backus Construction Co.:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Four-inch farm tile, per ft.	$0.05	$0.03	$0.05	$0.10	$0.02½	$0.15	$0.22	$0.10
Six-inch farm tile, per ft.	.10	.04	.07	.15	.04½	.25	.15	.18
14,195 ft. 8" vitrified sewer pipe	.13	.16	.17	.17	.10	.15	.17	.16
4,643 ft. 10" vitrified sewer pipe	.20	.22	.20½	.25	.15	.21	.24	.20
1,255 ft. 12" vitrified sewer pipe	.25	.27	.29	.32	.20	.30	.33	.25
1,540 ft. 15" vitrified sewer pipe	.40	.40	.40	.50	.30	.43	.45	.42
900 ft. 18" vitrified sewer pipe	.55	.50	.57	.65	.45	.60	.60	.65
14,520 ft. excavation and backfill, under 8'	.55	.50	.40	.42	.40	.45	.50	.34
2,415 ft. excavation and backfill, 8' to 10'	.75	.60	.65	.62	.50	.55	.70	.50
805 ft. excavation and backfill, 10' to 12'	.95	.80	1.75	.75	.75	.85	.95	.80
3,227 ft. excavation and backfill, 12' to 14'	1.20	1.05	2.25	1.22	1.00	1.25	1.00	1.10
1,000 ft. excavation and backfill, 14' to 16'	1.50	1.25	3.00	1.56	1.00	1.90	1.45	1.50
290 ft. excavation and backfill, 16' to 18'	2.00	2.25	3.50	1.85	2.20	1.95	1.80	1.50
312 ft. excavation and backfill, 18' to 20'	2.50	2.50	4.00	2.50	3.00	2.00	2.30	2.20
excavation and backfill, 20' to 22'	3.50	.....	4.50	2.75	4.00	2.50	3.00	5.00
56 manholes, complete (each)	35.00	40.00	30.00	58.00	28.00	39.00	35.00	30.00
11 flush tanks, complete (each)	100.00	100.00	75.00	130.00	55.00	68.00	100.00	75.00
10 drop manholes, complete (each)	50.00	50.00	60.00	80.00	60.00	65.00	35.00	50.00
Intercepting manholes, complete (each)	40.00	60.00	60.00	70.00	35.00	.....	35.00	50.00
Eighteen-inch sluice gates, complete (each)	.....	100.00	150.00	75.00	.....	150.00	110.00	100.00
36" = 1.1 ton c.-i. pipe, per ton	35.00	40.00	50.00	40.00	80.00	50.00	35.00	50.00
Portland cement concrete, per cu. yd.	10.00	7.00	10.00	5.50	5.00	10.00	7.50	10.00
Timber in foundations, per M. B. M.	40.00	40.00	40.00	38.00	25.00	25.00	25.00	35.00
Extra excavation, per cu. yd.	1.50	.50	1.00	.75	.45	.75	.80	2.00
Rock excavation, per cu. yd.	3.00	2.00	2.00	1.00	.90	3.00	3.90	4.50
Disposal works, electric motor	.....	8,000.00	17,600.00	22,000.00	20,000.00	23,000.00	15,000.00	24,100.00
Disposal works, water motor	.....	8,000.00	17,400.00	21,900.00	.....	22,900.00	15,000.00	24,124.00
Total, without disposal	$25,092	.....	.....	.....	.....	.....	.....	.....
Total, with disposal, electric motor	.....	$32,005	$46,928	$47,803	$40,115	$47,060	$39,255	$44,665
Total, with disposal, water motor	.....	$32,005	$46,728	$47,765	.....	$46,960	$39,255	$44,689

MISCELLANEOUS CONTRACTS.

(Continued from page 181.)

CONDUIT, CABLE ... Bids are asked by C... Corps Engrs., U. S. A. ... 25, for constructing ... electric conduit and in... ...Fort, Riley, Kan.—W. M. Whitman, ... until 10 a. m., Nov. ...oximately 750 ft. ...ation of cable, etc.

STORAGE CABINET ... Bids are asked until 3 ... Park Board for constr... ...g 40 metal stor... age cabinets for labora... ..., new west wing, Museum of Natural H... ...ry, Boro. of Manhattan.

WHARVES.—Mobile, ... Construction Co., of ... ...—The J. T. Jett ... lowest bid for building ... ...ocks and wharves at Choctaw Point for M... ...y & Miller, Antwerp Bldg., Mobile. The ... ...Dredging Co. was the only bidder for ... dredging.

TOWING.—New York, N. Y.—Bids are asked by Allen N. Spoo... Comr. of Docks, until noon, Nov. 23, for furnishing all the labor and materials req... ...ed for furnishing about 2,000 hours' tow... ...service on the North and East Rivers. ...ontract No. 1900.

DREDGE WORK.—Bancroft, Iowa.—The Central Dredging Co., 17 ... Commercial Bank Bldg., Cleveland, Ohio, ha... about 290,000 cu. yds. of dredge work, all ... to 12 ft. bottom, to sublet at Bancroft, Iowa. H. B. Whitney, Supt., Bancroft, will receive the bids.

LUMBER.—Leavenworth, Kan.—Bids will be received until Dec. 1 ... by R. V. LaDow, Supt. of Prisons and Prisoners, Dept. of Justice, Washington, D. C., for furnishing and delivering at the U. S. Penitentiary at Leavenworth 150 pieces of oak lumber.

PAVEMENT LIGHTS.—New York, N. Y.—Bids are asked by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, until 4 p. m., Nov. 23, for installing reinforced-concrete lens pavement lights at Public School No. 37, 145th and 146th Sts east of Willis Ave., Boro. of The Bronx.

DIKE.—North Mankato (Mankato Post-Office), Minn.—Bids were received until Oct. 31 by the Village Council for furnishing material and constructing a dike along the river. C. A. Kene, Village Recorder. Contract was awarded to FISHER & McDONALD, of North Mankato, at 29½ cts. per cu. yd. for filling and 70 cts. for riprap. Estimated cost, $3,700.

***TUNNEL, SHAFT, ELEVATOR.**—Niagara Falls, N. Y.—Bids are asked by Edward H. Perry, Supt. State Reservation, Niagara Falls, until 10.30 a. m., Dec. 4, for (A) construction complete, including plumbing, electric heating and lighting for shaft and tunnel, and inclined foot path; and (B) for elevators, including machinery, at the State Reservation.

EARTHWORK.—New Orleans, La.—Bids were received on Oct. 31 by Capt. H. Burgess, Corps Engrs., U. S. A., Mississippi River Commission, Fourth District, 3338 St. Charles Ave., for constructing about 37,000 cu. yds. of earthwork in the Lake Borgne levee district. Contract has been awarded to JOSEPH HINGLE, of Homeplace, La., at 29½ cts. per cu. yd.

STEAMER.—Ottawa, Ont.—Bids are asked by the Department of Marine and Fisheries, Ottawa, until noon, Dec. 10, for the construction of a twin screw steel steamer for the Hydrographic Service on the Atlantic Coast, of the following leading dimensions, namely: Length over all, 173½ ft.; breadth of beam molded, 29 ft.; depth, 15½ ft.; to be delivered at Sorel, Que.

***TILE DRAINS.**—Peoria, Ill.—Bids are asked by the Commissioners of the Hallock and Medina Drainage District of Peoria County, at the office of W. S. Kellogg, Attorney, 100 South Jefferson Ave., Peoria, Ill., until 2 p. m., Dec. 14, for furnishing and laying 31,757 ft. of drain tile ranging in size from 8 to 30 ins. diameter. Harman Engineering Co., 120 Fredonia Ave., Peoria, Engrs.

SODIUM NITRATE.—Washington, D. C.—Bids were received as follows on Nov. 13, at the office of the Chief of Ordnance, War Department, Washington, D. C., for furnishing 5,000,000 lbs. of sodium nitrate at the Picatinny Arsenal, N. J.: W. R. Grace & Co., New York, $2.35 per 100 lbs.; Wessel, Duval & Co., New York, $2.3625; Parsons & Petit, New York, $2.3725; Heller, Hirsch & Co., New York, $2.395.

DOCKS.—Troy, N. Y.—Bids were received on Nov. 6 by the Board of Contract and Supply for extending a portion of Rensselaer St. by constructing docks and wing docks (with timber or concrete construction), constructing a sewer extension and grading and improving this portion of the street. James M. Roley, Secy. Bids were as follows—(a) timber; (b) concrete construction: Richard Parrott, (a) $7,836, (b) $9,197; John Flynn, Jr., (a) $7,139, (b) $7,989; McDonough Construction Co., (b) $7,027; ROBT. J. GLEASON, (a) $5,931, (b) $6,931 (awarded contract); Golden & Lansing, (a) $8,337, (b) $8,290.

LEVEES.—New Orleans, La.—Bids were received by the Mississippi River Commission, Fourth District, 1539 Louisiana Ave., on Oct. 15 for constructing about 461,500 cu. yds. of levee work in Lower Tensas and Pontchartrain Levee districts: HARRIS & LARKIN, Natchez, Miss., were awarded the following contracts: 75,000 cu. yds. Hahn Levee; 74,500 cu. yds. Hewitt Levee; 74,500 cu. yds. Aurora Levee; 75,000 cu. yds. Limerick Levee; 74,500 cu. yds., Burn Levee, all at 32.4 cts. HEARIN & RYAN, Baton Rouge, La., 134,000 cu. yds., Longwood Levee, 16.94 cts. Capt. H. Burgess, Corps Engrs., U. S. A., 3338 St. Charles Ave., New Orleans.

CONCRETE WORK.—Chicago, Ill.—The Inter-State Contracting Co., 509 Monadnock Block, Chicago, has following new construction work which will be sub-let: At Joliet, Ill., on E. J. & E. R. R., about 2,000 cu. yds. concrete in retaining walls; also at the same place, about 80,000 cu. yds. excavation upon which extreme haul is less than 500 ft. Average haul about 200 ft. Material is earth. Suitable for elevating grade and

...vagons or wheelers. Also for Sanitary District of Chicago (Drainage Canal) about 50,000 cu. yds. top loam to be wasted over a 25-ft. berme. Also for a drag line machine material suitable for a Page or Channon type, with excavator of the 70 or 80-ft. boom.

RETAINING WALLS.—New York, N. Y.—Bids were received as follows by George Cromwell, President, Boro. of Richmond, on Nov. 10 for constructing a reinforced-concrete retaining wall on Stuyvesant Pl., and other work in connection with the St. George Ferry approach: Core-Meehan Co., $98,449; Butler Bros.-Hoff Co., $162,411; Geo. B. Spearin, $151,725; R. E. Henningham, $180,404; Jos. Johnson Sons, $221,398; Millard Const. Co., $137,235; Northeastern Construction Co., $137,644; St. George Contracting Co., $181,986; J. H. Gray & Co., $179,329; Rogers & Haggerty, $160,022; Phoenix Construction Co., $186,123; Turner Contruction Co., $166,658; Farrell Concrete Construction Co., $109,153; Isaac Hooper, $134,735; D. M. McLeod, $156,300; J. F. Walsh Co., $130,457.

FORMALDEHYDE DISINFECTING SYSTEM.—New York, N. Y.—The following bids were received on Nov. 12 by Robert W. Hebberd, Comr. Dept. of Public Charities, for providing all the labor and materials, including chambers, cars, formaldehyde retorts, transfer table, tracks, sleepers, tees, valves, piping, and all other work necessary to the installation of a combined steam and formaldehyde disinfecting system (except the supplying and installing of a vacuum pump), for the Municipal Lodging House, situated approximately 400 ft. east of First Ave. and on the southerly side of 25th St., Boro. of Manhattan: Kensington Engine Works Co., Beach & Berks St., Philadelphia, Pa., $19,375; Kny-Scherer Co., 404 West 27th St., New York, $22,395.

•BARGE CANAL.—Albany, N. Y.—Bids were received by F. C. Stevens, Supt. of Public Works, on Nov. 17, for two additional barge Canal contracts as follows: Contract No. 40, for the improvement of the Erie Canal from Lockport to Sulphur Springs Guard Lock; length, 4.84 miles; and on Contract No. 46 which is for the construction of the canal from Fox Ridge to the southeast corner of the town of Galen; length, 9.44 miles. The bids were: For Contract No. 40, Engineer's estimate, $2,516,743: Buffalo Dredging Co., Buffalo, N. Y., $2,306,702; Mason & Hanger Co., and Millard & Lupton Co., 50 Church St., New York, $2,283,113; MacArthur Bros. Co., 11 Pine St., New York, $2,199,026; United Engineering & Contracting Co., $2,166,298; American Pipe Mfg. Co., 112 North Broad St., Philadelphia, $2,247,358. For Contract No. 46: Engineer's estimate, $1,367,583; P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J., $1,464,218; Kinser Construction Co., Railway Exchange, Chicago, Ill., and Fort Edward, N. Y., $1,212,833; Crowell & Sherman Co., 3111 Carnegie Ave., Cleveland, Ohio, $1,251,072; Shanley-Morrissey, Inc., 527 Fifth Ave., New York, $1,330,710; North American Dredging Co., 839 Park Row Bldg., New York, $1,267,408; American Pipe Mfg. Co., Philadelphia, $1,362,400; Booth & Flynn, Ltd., Pittsburg, Pa., $1,274,830. Frederick Skene is State Engr.

U. S. POSSESSIONS AND CUBA.

•BOILERS, ETC.—Panama.—Bids are asked until 10.30 a. m., Dec. 14, by Capt. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for boilers, with stack, breeching, uptakes and fittings, surface condenser, generator and engine, brake-rod connection pins, brake-shoe keys, truck-bolster center plates, coupler knuckle pins, steel tubing, gaskets, mortising chisels, machine bits and bitstocks, hemp rope, plate glass, etc.

CIVIL SERVICE EXAMINATIONS.

ASSISTANT INSPECTOR.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 9, to secure eligibles from which to make certification to fill a vacancy in the position of Assistant Inspector of Incandescent Lamps, $840 a year, Quartermaster's Department at Large, Washington, D. C., and vacancies requiring similar qualifications as they may occur. Age limit, 20 years. Application Form 1003.

ASSISTANT.—Washington, D. C.—The U. S. Civil Service Commission announces the postponement to Dec. 9-10, of the examination scheduled for Nov. 16-17, to secure eligibles from which to make certification to fill a vacancy in the position of Assistant (male), at $1,000 a year, in the Naval Observatory, Navy Department, Washington, D. C., and vacancies requiring similar qualifications as they may occur. Age limit, 20 years or over on the date of the examination, but preference in appointment will be given to eligibles under 35 years of age. Application Form 1312.

COMPUTER.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 9-10, to secure eligibles from which to make certification to fill two vacancies in the position of Piecework Computer, Nautical Almanac Office, Navy Department, and vacancies requiring similar qualifications as they may occur in that office. The Department states that Piecework Computers are paid according to the kind and quantity of work performed and that beginners earn from $700 to $900 a year. Promotions are made from this grade without further examination to the grade of Assistant, as vacancies occur. The salaries of Assistants range from $1,000 to $1,600 a year. Age limit, 20 years. Application Form 1312.

COMPUTER (Male).—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 9-10, to secure eligibles from which to make certification to fill a vacancy in the position of Miscellaneous Computer, Naval Observatory, Washington, D. C., and vacancies requiring similar qualifications as they may occur in that observatory. The department states that Miscellaneous Computers are paid by the hour and earn from $1,000 to $1,200 a year. Promotions are made from this grade, without further examination, to the grade of Assistant, at $1,200 a year, as vacancies occur. Age limit, 20 years or over on the date of the examination, but preference in appointment will be given to eligibles under 35 years of age. Application Form 1312.

LABORATORY ASSISTANT.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 15 to secure eligibles from which to make certification to fill a vacancy in the position of Laboratory Assistant (qualified in Chemistry), male, $1,000 a year, a vacancy in the position of Assistant Physicist (qualified in Mechanical Engineering), at $1,000 a year, in the Bureau of Standards, and vacancies requiring similar qualifications as they may occur. The duties in connection with these positions are identical with those of the assistants in the physical laboratories of scientific and technical institutions. The duties of Assistant Physicist in Mechanical Engineering, include assisting in the testing and investigation of engineering instruments and materials. Age limit, 20 to 35 years. Application Form 1312. Applications must be filed prior to closing hour on Dec. 4.

OFFICE ENGINEER.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 2, to secure eligibles from which to make certification to fill three or more vacancies in the position of Office Engineer in Irrigation and Drainage Investigations, Office of Experiment Stations, Department of Agriculture, at salaries ranging from $1,200 to $2,000 a year, and vacancies requiring similar qualifications as they may occur in that Department. In addition to general and technical education and experience, the application should show especially the training, experience, and ability of the competitor in general agriculture and agricultural irrigation and drainage, hydraulics, editing, abstracting and indexing, office routine, and administrative and executive duties, and together with the testimonials should give proof of his tact and business ability. Candidates who do not receive a rating of at least 70 per cent. on education, training, and experience will not be rated upon the remaining subjects. Age limit, 21 years. Application Form 304 and special form. Applications must be filed prior to closing hour on Dec. 2.

INDUSTRIAL NOTES.

THE KINSFORD FOUNDRY & MACHINE WORKS, Oswego, N. Y., report the receipt, during a recent week, of orders for five boilers. The plant of this concern has been operated at practically full time during the past year.

THE PITTSBURG TESTING LABORATORY, Pittsburg, Pa., has the contract for making inspections and tests of materials, machinery and mechanical devices for the U. S. Reclamation Service for the fiscal year ending June 30, 1909.

THE NATIONAL CEMENT & PLASTER ASSOCIATION will hold a cement-rock products exhibition in Denver, Colo., from the 18th to the 22d of January, 1909. Further particulars of this exhibition may be obtained by addressing the Colorado Portland Cement Co., Denver, Colo.

BYLLESBY & CO., 500 American Trust Bldg., Chicago, Ill., are engineers for an extension to the plant of the Consolidated Gas & Electric Co., of San Diego, Cal. The equipment will contain a 2,000-HP. Allis-Chalmers engine, 1,250-KW. generator, Worthington Condenser and Babcock & Wilcox boiler.

THE NATIONAL WOOD PIPE CO., Los Angeles, Cal., advises that it has been awarded contract for over 40,000 ft. of 4, 6, 8 and 10-in. machine banded wood pipe for installation in the Teague, Texas, municipal water system, John W. Maxcy, Houston, Texas, Consult. Engr. The city of Teague will install a complete municipal works system.

BURDETT LOOMIS, JR., has opened a sales office in the Connecticut Mutual Bldg., Hartford, Conn., where he will look after the interests of the Power & Mining Machinery Co., builders of the Loomis-Pettibone gas producers and also the Snow Steam Pump Works of Buffalo, N. Y., builders of the Snow horizontal double-acting gas engines in all sizes.

THE YOUNGSTOWN CAR MFG. CO., Youngstown, Ohio, states that it has received an order for 200 all-steel coal mine cars from the Monongahela River Consolidated Coal & Coke Co., of Pittsburg, Pa. The company had previously received an order for 200 of these cars, and this additional order is given after delivery has been made on the first lot.

THE U. S. STEEL CORPORATION, according to statements by its President to the press, will expend about $10,000,000 immediately in the vicinity of Pittsburg. A large portion of this amount will be spent on a large car wheel plant, which will utilize a new process of pressing car wheels. The corporation is now running within 60 per cent. of its capacity.

THE CONCRETE STEEL CO., 29 Broadway, New York, manufacturers of the "Havemeyer" bar for reinforcing concrete, reports considerable new business of late and that prospects for concrete work in the next year are very promising. The company has placed agencies for this bar in several of the leading cities and will consider applications from reliable firms for further representation.

THE HOLME CO., 34 West 26th St., New York, states that it is now engaged on the following contracts for making and driving Corrugated Concrete Piles: East Tuberculosis Infirmary, Metropolitan Hospital, Blackwell's Island, New York, Raymond F. Almirall, Architect. 35-38 Gramercy Park, 12-story apartment, New York City, J. Riely Gordon, Architect. Quartermaster's Storehouse, Marine Corps, Brooklyn Navy Yard, Bruce, Price & de Sibour, Architects.

THE SPRAGUE ELECTRIC CO., New York City, has found it necessary in order to handle the increasing demand for its products in the Southern territoy to open a branch office in Atlanta, Ga., in addition to the New Orleans office. Both of these offices are under the management of F. V. L. Smith, who is well known in the South and who has been in charge of the Sprague Company's office in New Orleans, since its establishment. The Atlanta office is located in the Empire Building.

CAPT. EDWARD H. SCHULZ, U. S. Engineer's Office, Kansas City, Mo., has awarded the Raymond Concrete Pile Company, of New York and Chicago, a contract for placing reinforced concrete piles in the Missouri River, near Elwood, Kansas. These piles will be used for holding revetments in some river improvement work that is being carried out at the aforementioned locality. Heretofore wood piles were used in all of this work, but on account of their comparatively short life, from three to seven years, it was decided to substitute concrete piles.

THE BETHLEHEM STEEL CO., under date of Oct. 29, 1908, announces certain changes in its organization. The new personnel is as follows: C. M. Schwab, Pres.; A. Johnston, 1st Vice-Pres.; H. S. Snyder, 2d Vice-Pres.; E. G. Grace, Gen. Mgr.; C. A. Buck, Gen. Supt.; J. F. Meigs, Engr. of Ordnance; B. H. Jones, Secy. and Treas.; James Kernan, Asst. Secy. and Asst. Treas.; A. D. Mixsell, Gen. Sales Agt.; F. A. Shick, Audr.; R. S. Van Horn, Pur. Agt.; T. O. Cole, Traffic Mgr.; J. D. Hagenbuch, Asst. to Gen. Mgr.; J. H. Ward, Secy. to Pres.

THE ESTEY ORGAN CO., Brattleboro, Vt., which is the largest organ factory in the world, has recently placed with the Crocker-Wheeler Co., of Ampere, N. J., an order for 57 induction motors, ranging from ½ to 75 HP., together with seven transformers and a switchboard. Current will be purchased from the Connecticut River Power Co. Some of these motors will be used for driving individual machines and others for driving line shafting. The proper subdivision of the plant into groups and individual machines was successfully worked out by the engineers of the Crocker-Wheeler Co.

THE NATIONAL WOOD PIPE CO., Los Angeles, Cal., announces the receipt of diploma of award from the International Industrial Exposition and 28th Annual New Mexico Territorial Fair, held at Albuquerque, New Mexico, Sept. 29 to Oct. 10, 1908. This exposition and fair was held in connection with the 16th National Irrigation Congress. This diploma was "Awarded to National Wood Pipe Co. for best exhibit of wood pipe for city water-works, irrigating systems, mining and power plants." The company exhibited its machine bended redwood and fir pipe of various diameters and banded for various pressures up to 450' head, as well as numerous fittings which are used in municipal and irrigation systems.

WM. B. SCAIFE & SONS CO., Pittsburg, Pa., manufacturers of the Scaife and We-Fu-Go Water Softening and Purifying Systems, reports an extremely satisfactory year's business. Among some of the recent contracts are the following: Eastman Kodak Co., Rochester, N. Y., 3,000-HP. We-Fu-Go system: Armstrong Cork Co., Pittsburg, Pa., 2,250-HP. We-Fu-Go system (second order); Rochester & Pittsburg Coal & Iron Co., Punxsutawney, Pa., 750-HP. We-Fu-Go system (seventh order); Pittsburg-Buffalo Co., Burgettstown, Pa., 1,000-HP. We-Fu-Go system; Gowanda State Homeopathic Hospital, Gowanda, N. Y., 750-HP. We-Fu-Go system; Fort Pitt Hotel Co., Pittsburg, Pa., 1,000-HP. Scaife system; Rochester, Syracuse & Eastern Ry. Co., Syracuse, N. Y., 250-HP. Scaife automatic system.

THE ANGLO-NEWFOUNDLAND DEVELOPMENT CO., Grand Falls, Newfoundland, have awarded the contract for heating their paper mill buildings, now under construction at Grand Falls, to the American Blower Co., of Detroit, Mich. Four separate sets of apparatus will be installed, each consisting of a steel plate fan, direct connected engine and heater. The largest of these four sets will supply the machine room, beater room and pump room. An "A. B. C." full housed steel plate fan having a 13-ft. blast wheel of the Guibal type direct connected to a 13 × 16 horizontal engine and exhausting through 20 grouns of 60-in. "Vento" radiation will be employed. The second set will supply the screen room and includes a 9-ft. steel plate fan, a 10 × 12 engine and 2,684 sq. ft. of radiation. The remaining two sets consists each of an 8-ft., ¾-housed fan driven by a 9 × 7 type "A." self-oiling engine. One of these will supply the finishing room, mill supply room, roll grinding room and machine shop; the other will supply the generator room, grinder room and several lower floors. The generator room is to be heated to 60° F. in zero weather, all other rooms to 70° F. Air changes of from 10 to 30 minutes are required in the various rooms mentioned.

The four sets have a combined capacity of 267,000 cu. ft. of heated air per min. A total of 13,827 sq. ft. of cast-iron indirect radiation will be used, and about 25 tons of galvanized steel sheets are required for the air distributing ducts.

EXHIBITS AT THE ANNUAL CONVENTION OF THE ROADMASTERS' AND MAINTENANCE-OF-WAY ASSOCIATION: held at the Blatz Hotel, Milwaukee, Wis., Nov. 10 to 12:

Allis-Chalmers Co., Milwaukee, Wis.—Rock and ballast crushing plant.

American Hoist & Derrick Co., St. Paul, Minn.—Railway ditching machine.

American Railway Device Co., 105 South Clinton St., Chicago.—Tool grinder attachment for hand cars.

American Steel & Wire Co., Chicago.—Woven wire fencing.

American Valve & Meter Co., Cincinnati, Ohio.—Switchstands, water columns and tank fittings.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis.—Tie-plates.

Buda Foundry & Mfg. Co., Chicago.—Motor cars for roadmasters and section gangs; track tools.

Canadian Rail Joint Co., Toronto, Canada.—The Williams reinforced angle bar, in which the thickness increases from the ends toward the middle.

Carnegie Steel Co., Pittsburg, Pa.—The Carnegie steel I-beam tie and the Duquesne rail joint.

Louis Dunn, Minneapolis, Minn.—Safety switch, switch indicator, for calculating dimensions for turnouts, etc.

Economy Separable Switch Point Co., Louisville, Ky.—Drop-forged steel points for repairing old switch rails.

F. M. Foster, Columbus, Ohio.—Interlocking switchstand.

Hayes Track Appliance Co., Geneva, N. Y.—Derails for sidings and interlocking plants.

National Lock Washer Co., Newark, N. J.—Nutlocks.

The Rail Joint Co., New York.—Samples of different styles of joints.

Railroad Supply Co., Chicago.—Tie-plates, derails and track specialties.

Railway Specialty & Supply Co., Chicago.—Rail anchors to prevent creeping of rails.

John M. Scott Sons, Racine, Wis.—Bumping posts, nutlocks and corrugated spikes.

W. R. Thomas, Watertown, Wis.—A boltless rail joint.

U. S. Wind Engine & Pump Co., Batavia, Ill.—Railway water tanks, water station equipment, and switchstands.

Universal Portland Cement Co., Chicago.—Portland cement.

A. Winance, Portland, Ore.—Rail joint.

W. & L. E. GURLEY, Troy, N. Y., manufacturers of engineering and surveying instruments and appliances, have established a branch factory in the Manufacturers' Exchange Building, King and Occidental Sts., Seattle, Wash.

TRADE PUBLICATIONS.

PORTLAND CEMENT.—Altoona Portland Cement Co., Altoona, Kan., and Kansas City, Mo. Paper; 5½ × 7 ins.; pp. 20; illustrated.

Reports are given on the company's properties and plant.

WATERPROOFING MATERIAL.—Ironite Co., 84 La Salle St., Chicago. Paper; 3¼ × 6¼ ins.; pp. 6.

This material is for waterproofing concrete, brick and stone. Some testimonials from architects are given.

PORTLAND CEMENT.—Kansas City Portland Cement Co., 314 R. A. Long Building, Kansas City, Mo. Paper; 6 × 9¼ ins.; pp. 12; illustrated.

This presents several views of buildings in which the company's cement has been used.

CONCRETE REINFORCEMENT.—Expanded Metal & Corrugated Bar Co., St. Louis, Mo. 9¼ × 8 ins.; folder; illustrated.

In this folder are illustrated and listed the two new types of the well-known corrugated bar for reinforcing concrete.

WINDOW VENTILATORS.—The Pullman Automatic Ventilator Mfg. Co., York, Pa. Paper; 4½ × 6 ins.; pp. 8; illustrated.

These ventilators are for use in office windows, to give a sufficient supply of fresh air without causing a draft.

CONCRETE MIXER.—The United Cement Machinery Mfg. Co., Burlington, Ia. Paper; 8 × 12¼ ins.; pp. 4.

The mixer is of the revolving drum type, and is shown mounted on a steel truck which also carries an engine and boiler.

FIRE BRICK.—The Garden City Sand Co., Security Building, Chicago. Paper; 5 × 7 ins.; pp. 28; illustrated.

This is an illustrated catalog of bricks and blocks for lining kilns, furnaces, smokestacks, cupolas, etc. Tile and fireclay are included.

PORTLAND CEMENT.—Bonner Portland Cement Co., Kansas City, Mo. Paper; 12 × 9 ins.; pp. 53; illustrated.

The pamphlet consists mainly of particulars of the company's plant and property, together with reports of analyses of the raw materials and the cement.

GRAB BUCKETS.—Andresen-Evans Co., Monadnock Block, Chicago. 11⅛ × 8⅝ ins.; pp. 16; illustrated.

This special catalog is devoted to a list of the various grab buckets for ore and coal handling plants made by the above noted company.

CONCRETE JOISTS.—The Vaughan Co., 309 Union Trust Bldg., Detroit, Mich. 3¼ × 6 ins.; folder; illustrated.

The joists made by this company are built in the shop, in exaggerated I-beam sections, heavily reinforced and shipped to any place as required.

CRANES.—Whiting Foundry Equipment Co., Harvey, Ill. Paper; 6 × 9 ins.; pp. 8; illustrated.

Typical installations of travelling and swinging cranes in various railroad shops about the country are pictured in these few pages.

STEAM PILE HAMMER.—A. F. Bartlett & Co., Saginaw, Mich. 9 × 12 ins.; folders; illustrated.

To those who are not familiar with the exact mode of operation of the steam hammer for pile driving the description in this catalog should be very useful.

CONCRETE BLOCK MOLDING MACHINES.—Coltrin-Boos Mfg. Co., 140 West Main St., Jackson, Mich. Paper; 7 × 5¼ ins.; pp. 32; illustrated.

The machines are for bricks and blocks of various designs. Information is given as to the preparation of the concrete and the making of the blocks.

PORTLAND CEMENT.—Peninsular Portland Cement Co., Jackson, Mich. Paper; 4 × 6 ins.; pp. 68; illustrated.

In addition to particulars of "Peninsular" cement, there is general information as to the varied uses of Portland cement for engineering, architectural and decorative work.

CONCRETE MIXERS.—Kingston Mfg. Co., Wilkesbarre, Pa. 6 × 9 ins.; pp. 8; illustrated.

The Hadsee concrete mixer, described in this catalog is a batch-mixer consisting of an octagonal drum built up of eight heavy cast-iron segments riveted together, and two heavy steel plate sides.

STEEL SHEET PILING.—Wemlinger Steel Piling Co., 11 Broadway, New York. Large folder; illustrated.

The Wemlinger steel sheet piling, advocated by this folder, consists of long piece of longitudinally curved iron plates, somewhat like corrugated iron, which can be driven in either single or double lap.

WHEELBARROWS.—The Toledo Wheelbarrow Co., Toledo, O. Paper; 6 × 9½ ins.; pp. 44; illustrated.

Steel and wooden wheelbarrows for contractors' use and special purposes are shown in considerable variety. Concrete barrows and dump cars are included. Prices are given in all cases.

STEEL WHEELBARROWS AND TRUCKS.—Archer Iron Works, Chicago. Paper; 7 × 9½ ins.; pp. 8; illustrated.

This is a price list of wheelbarrows of various design, including dump barrows and carts for handling concrete. The trucks and cars are for use in mines, industrial plants, etc., and on contract works.

CONCRETE MIXER.—The Knickerbocker Co., Jackson, Mich. Paper; 3½ × 6 ins.; pp. 16; illustrated.

The Coltrin mixer has a horizontal revolving cylinder fitted with mixing blades. Several portable outfits are shown, driven by belting or by direct connection with an Ideal gasoline engine mounted on the machine.

STEEL WHEELBARROWS AND CARS.—Sterling Wheelbarrow Co., 238 Oregon St., Milwaukee, Wis. Paper folder; 15 × 22 ins.; illustrated.

This shows a variety of concrete barrows and carts, and wheelbarrows for contractors' work. The concrete carriers range from 3½ to 6 cu. yds. capacity. Descriptions are given of the construction and special features.

CEMENT MACHINERY.—Vulcan Iron Works, Wilkesbarre, Pa. 6 × 9 ins.; pp. 23; illustrated.

The title notes that this company carries a complete line of machinery for burning, drying and cooling Portland cement, either wet or dry process and the catalog itself illustrates and describes many of these devices.

VALVES FOR WATER-WORKS.—Globe-Anderson Valve Specialty Co., Fulton Building, Pittsburg, Pa. Paper; 8½ × 11 ins.; pp. 4; illustrated.

The circular gives a brief description of automatic water service valves, float valves, altitude valves and standpipe valves. All of these are cushioned. Steam valves and the Golden tilting steam trap are listed also.

CONCRETE REINFORCING METAL GOODS.—The General Fireproofing Co., Youngstown, Ohio. 3½ × 8 ins.; pp. 24; illustrated.

This is a listed catalog of the various metal goods manufactured by the company comprising metal lath, corner bead, studding, metal furring, wall-ties and concrete reinforcement.

ADJUSTABLE STEEL CENTERS FOR CONCRETE.—Adjustable Steel Centering Co., 71 S. Main St., Fond du Lac, Wis. Paper; two pamphlets; each 3½ × 6¾ ins.; pp. 8; illustrated.

The centering is for sewers, culverts, etc., from 12 to 48 ins. diameter or for egg-shape sections up to 36 × 54 ins. Testimonials are given and illustrations show the centering in use.

CARS, TRUCKS AND BOLSTERS.—Bettendorf Axle Co., Davenport, Ia. Paper; 9½ × 6¾ ins.; pp. 64; illustrated.

Arch-bar or diamond-frame trucks having cast steel side frames and bolsters occupy a considerable part of this pamphlet, and are shown as applied to various types of cars. Other specialties are I-beam bolsters (with the web corrugated to form a fish-belly member); cast-steel fittings for underframes and tank cars with steel underframes.

AIR WASHER.—The Donaldson Co., 7333 Wentworth Ave., Chicago. Paper; 8½ × 11 ins.; pp. 4; illustrated.

The Eclipse air washer and humidifier is a device for use in connection with ventilating plants. The air passes through a spray of water which removes the dust particles, after which the excess of moisture in the air is removed.

CONCRETE MACHINERY.—Waterloo Cement Machinery Co., Waterloo, Ia. Paper; 6 × 3½ ins.; pp. 23; illustrated.

The machinery includes the Polygon drum concrete mixer (in various sizes), the Stewart cement block machine, steel wheelbarrows and the Yale gasoline engine. A special folder deals with the Stewart block machine and the Baldwin portable hand-power concrete mixer.

CEMENT AND CONCRETE MACHINERY.—Cement Machinery Mfg. Co., Columbus, O. Paper; 9 × 12 ins.; pp. 116; illustrated.

This is a catalog and price list of molding machines for blocks of various kinds; also for tile, tanks and cisterns. Concrete mixers and hand tools are listed, together with tampers, cars for handling blocks and other specialties.

CEMENT FOR BUILDING CONSTRUCTION.—Marquette Cement Mfg. Co., Marquette Building, Chicago. Paper; 6 × 9 ins.; pp. 8; illustrated.

This pamphlet shows views of the La Salle Hotel, now being built in Chicago at a cost of some $3,500,000. The Marquette Portland cement is used in the foundation caissons and reinforced-concrete work, about 25,000 barrels being supplied.

WIRELESS TELEGRAPH SETS.—Collins Wireless Telephone Co. Paper; 6 × 9 ins.; pp. 12; illustrated.

This catalog describes several wireless telegraph sets from the simplest boys' instruments to those having syntonic adjustment.

This catalog is accompanied by Vol. I. No. 2, of the "Collins Bulletin," filled with items relating to the company's apparatus and business.

PORTLAND CEMENT.—Peerless Portland Cement Co., Union City, Mich. Paper; 6 × 9 ins.; pp. 71; illustrated.

This pamphlet describes the process of manufacture as employed at the company's works, and gives the results of a number of laboratory tests made by engineers. There are also numerous testimonial letters and views of structures in which Peerless cement has been used.

PLASTIC PORTLAND CEMENT.—Garden City Sand Co., 188 Madison St., Chicago. Paper; 4 × 9 ins.; pp. 40; illustrated.

This is a descriptive pamphlet and price list of "Stonekote" for the finish of buildings, and gives particulars for its application for both exterior and interior finish. It can be applied to stone, brick, concrete or lathing. Views of buildings thus treated are given, together with testimonials.

BAGS AND BAG FILLING MACHINES.—The Urschel-Bates Valve Bag Co., Toledo, O. Paper; 6¼ × 9½ ins.; pp. 20; illustrated.

The bags are for cement, hydrated lime, etc., and are closed by folding, no string being required to secure them. When filled they form flat packages. The filling machines automatically feed, fill and weigh several bags simultaneously. Details are given of the machines and their operation.

ENAMEL CONCRETE BRICK.—The Enamel Concrete Co., Des Moines, Ia. Paper; 5½ × 9 ins.; pp. 30; illustrated.

The bricks are made under heavy pressure in a machine, and have a highly-finished and glassy surface which is an integral part of the brick. The facing material is deposited in the molds before the concrete for the body of the brick, and the mass is then subjected to pressure. The machine makes eight bricks at each stroke.

DAMP-PROOF PAINTS.—Toch Brothers, 320 Fifth Ave., New York, N. Y. Stiff boards; 7 × 10 ins.; pp. 132; illustrated.

These paints are of various kinds, adapted for different kinds of work. Some are for protecting steel and others for concrete. There is a special cement-base paint for steel, and a preparation for mixing with cement to produce waterproof concrete. A large part of the book is devoted to half-tone engravings of bridges, buildings, steamers, etc., in which the company's materials have been used.

PAINT AND VARNISH.—The Lowe Brothers Co., Dayton, O. Paper; three pamphlets; 5 × 9 ins.; pp. 20; 5 × 9 ins.; pp. 14; 4½ × 7 ins.; pp. 43; all illustrated.

The proper methods of painting to be employed for different materials are described in the first pamphlet, which also gives particulars of the company's paints. Protective paint for structural and manufacturing purposes is the subject of the second pamphlet. The third is a catalog of the various paints and varnishes which the company manufactures. With these is a folding sheet of color samples of the Lowe liquid paints.

WHEELBARROWS, DRAG AND WHEEL SCRAPERS, AND CONTRACTORS' DUMP WAGONS AND CARS.—The Kilbourne & Jacobs Mfg. Co., Columbus, O. Paper; two pamphlets; 6 × 9 ins.; pp. 96; 8 × 10½ ins.; pp. 15; both illustrated.

The first is a general catalog of a great variety of wheelbarrows, hand carts, contractors' dump wagons, concrete trucks, etc. Drag and wheeled scrapers and grading plows are included. The second pamphlet is devoted to contractors' railway dump cars, ranging from 1½-yd. four-wheel cars to 16-yd. cars mounted on trucks. These last are built of steel and operated by means of air cylinders.

PULVERIZERS.—American Pulverizer Co., 121 Pine St., St. Louis, Mo. Paper; 7½ × 9 ins.; pp. 12; illustrated.

The "American" pulverizer consists of revolving arms having their ends fitted alternately with pivoted hammers and loose steel rings. These revolve in a casing having a cylindrical bottom, part of which forms a screen for the discharge of material pulverized to the required fineness. The machines are used for stone, cement and various other materials. The pamphlet also describes the company's revolving screens and its air separators for separating and discharging dust from the pulverizer or other disintegrating machinery.

CRUSHING MACHINERY.—George V. Cresson Co., 90 West St., New York City. Catalog No. 5, Aug., 1908. 6 × 9 ins.; pp. 72; illustrated.

The Department of Crushing and Concentrating of the Cresson Co. describes in this catalog all of the latest types of crushing machinery made by that firm, including stationary and portable rock crushers, stone crushers, bins, elevators, revolving screens, plaster crushers, corrugated rolls, magnetic separators, belt separators.

REINFORCED-CONCRETE PIPE.—The Reinforced-Concrete Pipe Co., Jackson, Mich. 9 × 12 ins.; pp. 68; illustrated.

The pipe described in this catalog is of concrete reinforced with circumferential and longitudinal flat steel bands, interlocked with each other, the longitudinal ones protruding from each short length of pipe as constructed so as to join to the next. The pipes are made and laid by the company itself in the trench in short sections.

FIREPROOF CONSTRUCTION.—National Fireproofing Co., Chicago, Commercial Nat. Bank Bldg. 7½ × 10 ins.; pp. 60; illustrated.

The title of this pamphlet is "Long Span Fireproof Construction in Reinforced Terra Cotta Hollow Tile, Portraying the Application of the Newest Methods in Use." It is devoted to illustrations, tables and descriptions of the hollow terra-cotta tile construction for floors, partitions and columns. In contrast to many similar publications its statements, while naturally partisan, show a fairness in this partisanship, which could be emulated with benefit by several other brick, tile and concrete fireproofing publications.

For other Proposal Advertisements see pages 43, 44, 45, 46, 49, of Advertisements and Construction News page 184.

BRIDGE SUPERSTRUCTURE.

THE SANITARY DISTRICT OF CHICAGO.

TO CONTRACTORS.

Sealed proposals, addressed to the Board of Trustees of the Sanitary District of Chicago, and indorsed "Proposals for the Superstructure of the C., M. & St. P. Ry. Bridge," will be received by the Clerk of the said Sanitary District at the offices of the said District, on the fifteenth floor of the American Trust Building, Chicago, Illinois, until 12 M., standard time, on Wednesday, December 2, 1908, and will be publicly opened by the Board of Trustees at a meeting to be held on that day, or the first meeting thereafter.

The work for which said tenders are invited, consists of the fabrication, erection and completion of the superstructure of a railroad bridge at the crossing of the Chicago, Milwaukee & St. Paul Railway over the North Shore Channel of the Sanitary District of Chicago, near Chancellor Street, in the City of Evanston, County of Cook, State of Illinois. Said work is to be comple[illegible] on or before June 1, 1909.

The said work is to [illegible] performed in accordance with plans, [illegible]fications and contract furnished by [illegible]anitary District of Chicago, which [illegible]s, specifications and contract may [illegible]tained upon application at the said [illegible] of the said District.

Each bid must be ac[illegible]anied by a certified check or cash to [illegible] amount of two thousand ($2,000.00) [illegible]ollars. All certified checks must be [illegible]n on some responsible bank doing business in the City of Chicago, and shall be made payable to the Clerk of the Sanitary District of Chicago. Said amount of two thousand ($2,000.00) dollars, deposited with bids, shall be held by the Sanitary District until all of the respective bids for said structure have been [illegible]assed and the contract awarded and signed. The return of said check or cash to the bidder to whom said work shall have been awarded will be conditioned upon his appearing within ten (10) days after receiving notice of such award, with bondsmen, and executing a contract with the Sanitary District for the work so awarded, and giving a bond, satisfactory to the Board of Trustees, for the fulfillment of said contract in the amount of twenty thousand ($20,000.00) dollars.

A deposit of ten ($10.00) dollars in cash or a certified check for that amount will be required for each set of plans and specifications taken out, the said sum of ten ($10.00) dollars to be refunded by the said Sanitary District upon the return of the said plans and specifications to said District, provided they are returned on or before December 21, 1908.

All bids must be upon blank forms furnished by the Sanitary District.

Bidders are required to state in their bids their individual names and places of residence in full.

The said Board of Trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO.

By ROBERT R. McCORMICK,
President of Its Board of Trustees.

Attest:
I. J. BRYAN, Clerk.

Chicago, November 18, 1908.

COUNTY ROAD.

3½ MILES.

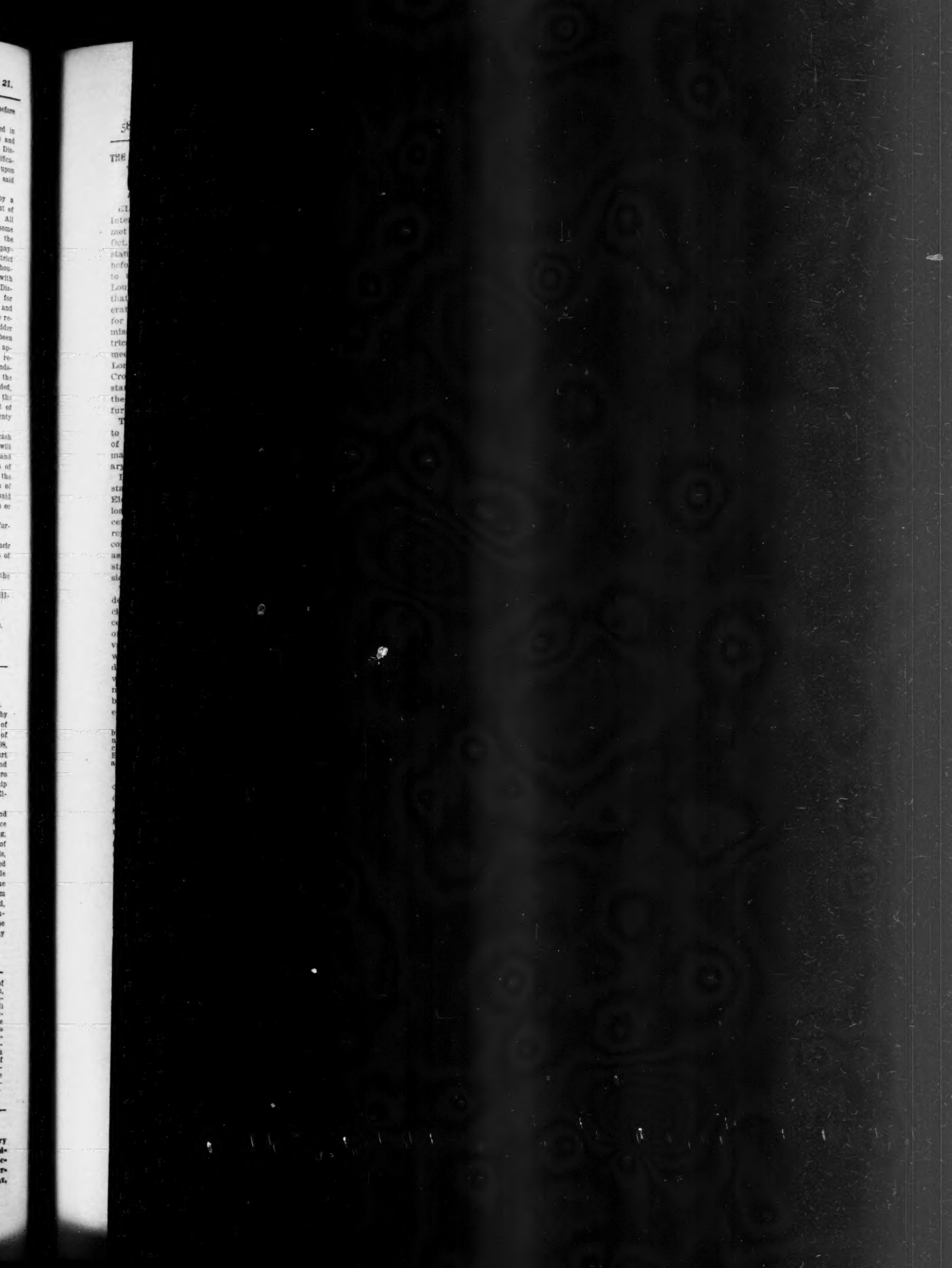
Salem, N. S., Nov. 17, 1908.

Sealed proposals will be received by the Road Committee of the Board of Chosen Freeholders, of the County of Salem, on Wednesday, December 9, 1908, at 10.30 o'clock, a. m., at the Court House, Salem, N. J., for grading and placing gravel surface on the Barnsboro Turnpike (3.31 miles), in the Township of Upper Pittsgrove, and Borough of Elmer, Salem County, N. J.

Specifications may be obtained and plans and profiles examined at the office of Howard B. Keasbey, Mecum Building, Salem, N. J., and also at the office of the State Commissioner of Public Roads, State House, Trenton, N. J. A certified check in the sum of $1,000, made payable to the order of the Directors of the Board of Chosen Freeholders of Salem County, N. J., must accompany each bid, as a guarantee that the bidder will enter into a contract should the work be awarded to him. The right to reject any or all bids is reserved.

JOHN F. AYARS,
Director.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., November 17, 1908.—Sealed proposals will be received at this office until 3 o'clock p. m., on the 29th day of December, 1908, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Post-Office at Alton, Ill., in accordance with drawings and specifications, copies of which may be obtained from the Custodian of Site at Alton, Ill., or at this office at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

NOTICE TO CONTRACTORS

We are advised by the Sanitary District, of Chicago, that the advertisement for Bridge Superstructure on page 44 of this issue is superseded by a similar advertisement, with later date, on this page.